H.H. WILLARD
CHEMISTRY BUILDING
UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN

UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Vol. 7, No. 18A
Abstracts 4985 - 5259
Sept. 30, 1953

Technical Information Service, Oak Ridge, Tennessee

UNIVERSITY OF MICHIGAN LIBRARIES

Chemistry Library
QC
770
.U56
v.7
no.18A

INTRODUCTION TO

NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission, Technical Information Service

The printing of this publication has been approved by
The Director of the Bureau of the Budget, August 2, 1951.

Nuclear Science Abstracts is issued twice monthly throughout the calendar year by the Atomic Energy Commission. It is intended primarily to serve scientists and engineers working within the Atomic Energy Project by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only the unclassified and declassified research reports of the Atomic Energy Commission and its contractors, but also material in its field of interest which appears in technical and scientific journals and unpublished research reports of government agencies, universities, and industrial research establishments.

DECLASSIFICATION

Issuing of these Abstracts does not constitute authority for declassification of any reports.

INDEXES

Nuclear Science Abstracts is fully indexed by author, subject, and report number. Annual index issues are prepared for each volume, and the next cumulated index will appear in volume 10(1956) covering volumes 5-10. A cumulated index to volumes 1-4 was issued as volume 4, No. 24B, Dec. 30, 1950 covering authors, subjects, nuclides, and report numbers. The 24th number of volumes 5 and 6 contain indexes covering the individual volumes and a completely cumulated Numerical Index of Reports.

Each issue of volume 7(1953) contains an author index to abstracts in that issue and a supplement to the Numerical Index of Reports. Subject and author indexes, as well as a cumulation of the Numerical Index of Reports, covering three-month periods are issued as supplements to the sixth twelfth, and eighteenth issues. The 24th issue will be the annual index for the year, superseding the three index supplements mentioned above.

AVAILABILITY

Nuclear Science Abstracts is available on sale at 25 cents per issue. It is also available on a subscription basis at six dollars ($6.00) a year domestic and ($8.00) foreign from

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Subscribers should send change of address notices to the above address. Nuclear Science Abstracts is also available on an exchange basis to universities, learned societies, research institutions, industrial firms, and publishers of scientific information. The Atomic Energy Commission invites correspondence from such organizations looking toward the exchange of publications. Inquiries regarding such exchanges and other official distribution as well as notices of address changes for official and exchange recipients should be sent to:

Technical Information Service
U. S. Atomic Energy Commission
P. O. Box 62
Oak Ridge, Tennessee

AEC RESEARCH AND DEVELOPMENT REPORTS

How to Locate AEC Reports. The Reports Reference List appearing in each issue indicates the declassified and unclassified research reports which are abstracted in that issue of Nuclear Science Abstracts.

Information regarding other AEC reports which have been abstracted is available in the cumulative Numerical Index of AEC Reports in Nuclear Science Abstracts, Vol. 6, No. 24A, Dec. 31, 1952, and the supplements to this index in each subsequent issue.

Reports for Sale. Many of these reports are for sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C. Prices for all of these items are indicated in the Numerical Index of Reports. Price lists for all items available for sale may be obtained upon request to the Office of Technical Services. Reports should be ordered by report number and title. A check or money order made payable to the Treasurer of the United States should accompany each order. Foreign purchasers of reports, other than those in Canada and Mexico, should include an additional amount for postage according to the scale that 4 pages approximate an ounce. Rates will vary for different countries. It will be the purchaser's responsibility to compute the necessary postage.

Reports Available Elsewhere. Many of these reports are, or will be, published in the scientific and technical journals, or in volumes of the National Nuclear Energy Series. The items already published are indicated in the Numerical Index of Reports.

Reports Not Published. AEC Reports for which no sale price or literature citation is given are obtainable on loan at the depository libraries. The complete series (NSF-tr) of National Science Foundation translations is also available at the depository libraries.

Non-AEC Reports. Reports prepared by organizations not under contract to the AEC should be requested from the

issuing agency indicated in the citation. Authors and titles should be used as identification for reports numbered in the NP-series since these numbers are applied by the AEC for internal convenience only.

British reports (AERE-series, etc.) should be requested from one of the special depositories of British reports, the New York Public Library, Duke University, Durham, University of California General Library, Berkeley, and John Crerar Library in Chicago, or from

British Information Services
30 Rockefeller Plaza
New York, New York

General Information on Location of AEC Reports. If the AEC report number is known, the searcher should go directly to the Numerical Index of AEC Reports in NSA, Vol. 6, No. 24A, Dec. 31, 1952, or to the supplements appearing in later individual issues. If the AEC report number is not known, searching is aided by the annual or cumulated Subject and Author Indexes. The indexes refer to an abstract from which the report number may be noted, and the information regarding availability can then be obtained from the Numerical Index of Reports. Declassified reports numbered MDDC and AECD through 2023 are indexed in the separate, Declassified Documents Cumulated Index, and their abstracts appear in the forerunner to NSA, Abstracts of Declassified Documents. These publications as well as the first five volumes of NSA are now out of print but may be consulted at the AEC depository libraries.

AEC DEPOSITORY LIBRARIES

CALIFORNIA
- Berkeley, University of California General Library
- Los Angeles, University of California Library

COLORADO
- Denver, Denver Public Library

CONNECTICUT
- New Haven, Yale University Library

DISTRICT OF COLUMBIA
- Washington, Library of Congress

GEORGIA
- Atlanta, Georgia Institute of Technology Library

ILLINOIS
- Chicago, John Crerar Library
- Chicago, University of Chicago Library
- Urbana, University of Illinois Library

INDIANA
- Lafayette, Purdue University Library

IOWA
- Ames, Iowa State College Library

KENTUCKY
- Lexington, University of Kentucky Library

LOUISIANA
- Baton Rouge, Louisiana State University Library

MASSACHUSETTS
- Cambridge, Harvard University Library
- Cambridge, Massachusetts Institute of Technology Library

MICHIGAN
- Ann Arbor, University of Michigan Library
- Detroit, Detroit Public Library

MINNESOTA
- Minneapolis, University of Minnesota Library

MISSOURI
- Kansas City, Linda Hall Library
- St. Louis, Washington University Library

NEW JERSEY
- Princeton, Princeton University Library

NEW MEXICO
- Albuquerque, University of New Mexico

NEW YORK
- Buffalo, Lockwood Memorial Library
- Ithaca, Cornell University Library
- New York, Columbia University Library
- New York, New York Public Library
- Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
- Durham, Duke University Library
- Raleigh, North Carolina State College Library

OHIO
- Cincinnati, University of Cincinnati Library
- Cleveland, Cleveland Public Library
- Columbus, Ohio State University Library

OKLAHOMA
- Stillwater, Oklahoma Agricultural and Mechanical College Library

OREGON
- Corvallis, Oregon State College Library

PENNSYLVANIA
- Philadelphia, University of Pennsylvania Library
- Pittsburgh, Carnegie Library of Pittsburgh

TENNESSEE
- Knoxville, University of Tennessee Library
- Nashville, Joint University Libraries

TEXAS
- Austin, University of Texas Library

UTAH
- Salt Lake City, University of Utah Library

WASHINGTON
- Seattle, University of Washington Library

WISCONSIN
- Madison, University of Wisconsin Library

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 No. 18A, September 30, 1953

TABLE OF CONTENTS

Category	Abstract	Page
CALENDAR OF MEETINGS		iv
REPORTS REFERENCE LIST		v
GENERAL	4985	607
Atomic Power	4985	
Research Programs	4986	
BIOLOGY AND MEDICINE	4987	607
Radiation Effects	4989	
Radiation Hazards and Protection	5003	
Radiation Sickness	5005	
Radiotherapy	5008	
Toxicology Studies	5009	
Tracer Applications	5010	
CHEMISTRY	5013	610
Analytical Procedures	5022	
Atomic Weights and Periodic Systems	5027	
Deuterium and Deuterium Compounds	5028	
Fluorine and Fluorine Compounds	5030	
Molecular Structure	5031	
Radiation Chemistry	5032	
Radiation Effects	5034	
Rare Earths and Rare-earth Compounds	5036	
Separation Procedures	5037	
Transuranic Elements and Compounds	5043	
Uranium and Uranium Compounds	5044	
ENGINEERING	5046	614
Materials Testing	5048	
Vacuum Systems	5049	
MINERALOGY, METALLURGY, AND CERAMICS	5053	615
Corrosion	5053	
Geology and Mineralogy	5056	
MINERALOGY, METALLURGY, AND CERAMICS		
Metals and Metallurgy	5063	
PHYSICS	5082	619
Aerosols	5087	
Cosmic Radiation	5088	
Crystallography and Crystal Structure	5102	
Electrical Discharge	5104	
Electrons	5105	
Gases	5109	
Instruments	5110	
Isotopes	5114	
Mass Spectrography	5116	
Mathematics	5121	
Measuring Instruments and Techniques	5123	
Mesons	5141	
Nuclear Physics	5149	
Nuclear Properties	5152	
Nuclear Reactors	5160	
Nuclear Transformation	5162	
Particle Accelerators	5179	
Radiation Absorption and Scattering	5186	
Radiation Effects	5202	
Radioactivity	5204	
Rare Earths and Rare-earth Compounds	5212	
Spectroscopy	5214	
Theoretical Physics	5220	
PATENTS	5232	636
Chemistry	5232	
Engineering	5235	
Physics	5236	
AUTHOR INDEX		A
NUMERICAL INDEX OF REPORTS		E

CALENDAR OF MEETINGS

Suggestions for additions to this list will be welcomed and should be sent with all pertinent information to the Cataloging Branch, Technical Information Service, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

October 18-22, 1953

SOCIETY FOR NONDESTRUCTIVE TESTING, INC., Cleveland, Ohio

October 29-30, 1953

CONFERENCE ON ATOMIC ENERGY, Waldorf-Astoria Hotel, New York, Sponsored by: National Industrial Conference Board.

Inquiries should be addressed to: R. Maxil Ballinger, Division of Business Practices, National Industrial Conference Board, 247 Park Avenue, New York 17, N. Y.

March 15-19, 1954

ELEVATED TEMPERATURE CORROSION SYMPOSIUM, Municipal Auditorium, Kansas City, Mo. Sponsored by: National Association of Corrosion Engineers – 10th Annual Conference

Person to Contact: Glenn A. Fitzlen
Ass't. Technical Director
Haynes Stellite Co.
Kokomo, Ind.

June 20-25, 1954

NUCLEAR ENERGY CONFERENCE, University of Michigan, Ann Arbor, Michigan, Sponsored by: American Institute of Chemical Engineers.

Inquiries should be addressed to: Professor Donald Katz, University of Michigan, Department of Engineers, Ann Arbor, Michigan.

REPORTS REFERENCE LIST

Vol. 7, No. 18A

The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

USAEC DECLASSIFIED REPORTS

AECD-3504 5013
Radiation Lab., Univ. of Calif., Berkeley
CHEMISTRY DIVISION QUARTERLY REPORT [FOR] DECEMBER 1952, JANUARY AND FEBRUARY 1953. Apr. 13, 1953. Decl. June 9, 1953. 49p. (AECD-3504; UCRL-2179)

USAEC UNCLASSIFIED REPORTS

AECU-2537 4986
[Los Alamos Scientific Lab.]
PAPERS PRESENTED AT THE CONFERENCE ON ATOMIC ENERGY EDUCATION [HELD] AT THE UNIVERSITY OF NEW MEXICO [ON] OCTOBER 17 AND 18, 1952. (AECU-2537)

AECU-2546 5037
Oak Ridge National Lab.
A COUNTERCURRENT SOLID-LIQUID CONTACTOR FOR CONTINUOUS ION EXCHANGE. I. R. Higgins and J. T. Roberts. [1952] 15p. (AECU-2546)

AECU-2603 5048
Johns-Manville Corp.
THERMAL INSULATION DEVELOPMENT: PROGRESS REPORT. S. Speil. June 10, 1953. 10p. (AECU-2603; Progress Report 6)

BNL-234 5110
Brookhaven National Lab.
NON-OVERLOAD AMPLIFIERS. W. A. Higinbotham. Apr. 1, 1953. 11p. (BNL-234)

BNL-1415 5010
Brookhaven National Lab.
MECHANISM OF HYDROLYSIS OF ADENOSINETRIPHOSPHATE CATALYZED BY LOBSTER MUSCLE. D. E. Koshland, Jr., and Edith Clarke. [1953] 40p. (BNL-1415)

BNL-1416 5011
Brookhaven National Lab.
STUDIES WITH RADIOPHOSPHORUS IN DROSOPHILA. 4. THE DISTRIBUTION AND TURNOVER OF PHOSPHORUS IN THE TISSUES OF D. MELANOGASTER. Robert C. King. [1953] 24p. (BNL-1416)

BNL-1419 4989
Brookhaven National Lab.
THE EFFECT OF CHRONIC GAMMA RADIATION ON MUTATIONS IN MAIZE. 1. ENDOSPERM MUTATIONS. 2. EFFECTS ON POLLEN. W. Ralph Singleton. [1953] 59p. (BNL-1419)

BNL-1422 5046
Brookhaven National Lab.
AN INSULATED UNION FOR METAL TUBING. Edward G. Reilly. [1953] 3p. (BNL-1422)

BNL-1425 4990
Brookhaven National Lab.
CYTOGENETIC EFFECTS OF X-RAY AND THERMAL NEUTRON IRRADIATION ON SEEDS OF BARLEY. Richard S. Caldecott, B. H. Beard, and C. O. Gardner; Nebraska Univ. and Brookhaven National Lab. [1953] 37p. (BNL-1425)

BNL-1438 5038
Brookhaven National Lab.
THE PREPARATION OF CHROMIUM-51 OF HIGH SPECIFIC ACTIVITY. Garman Harbottle, Brookhaven National Lab. and Alfred G. Maddock, Radiochemical Lab., Cambridge (England). [1953] 7p. (BNL-1438)

BNL-1485 5162
Brookhaven National Lab.
YIELD OF Xe^{133} IN THE THERMAL NEUTRON FISSION OF U^{235}. Seymour Katcoff and William Rubinson. [1953] 49p. (BNL-1485)

BNL-1487 5114
Brookhaven National Lab.
FRACTIONATION OF THE CARBON ISOTOPES IN DECARBOXYLATION REACTIONS. 6. COMPARISON OF THE INTERMOLECULAR ISOTOPE EFFECTS OF A PAIR OF ISOTOPIC ISOMERS. Jacob Bigeleisen and Max Wolfsberg. [1953] 7p. (BNL-1487)

BNL-1493 5031
Brookhaven National Lab.
NOTE ON A NITROGEN MOLECULE CALCULATION. Max Wolfsberg. [1952] 12p. (BNL-1493)

BNL-1501 5022
Brookhaven National Lab.
COLORIMETRIC DETERMINATION OF CYANIDE IN THE PRESENCE OF FERROCYANIDE. Virginia D. Hogan and Everett R. Johnson. [1953] 6p. (BNL-1501)

BNL-1502 4987
Brookhaven National Lab.
GROUP TRANSFER AS AN ENZYMATIC SUBSTITUTION MECHANISM. Daniel E. Koshland, Jr. [1953] 50p. (BNL-1502)

BNL-1503 5032
Brookhaven National Lab.
THE RADICAL PAIR YIELD OF IONIZING RADIATION IN SULFURIC ACID SOLUTIONS. Everett R. Johnson and Jerome Weiss. [1953] 19p. (BNL-1503)

BNL-1504 5141
Brookhaven National Lab.
ARTIFICIAL V PARTICLES: V^0'S PRODUCED AT THE COSMOTRON. W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore. [1953] 4p. (BNL-1504)

CF-53-7-137 5160
Oak Ridge National Lab.
CURRENT STATUS OF THE THEORY OF REACTOR DYNAMICS. W. K. Ergen. July 20, 1953. 17p. (CF-53-7-137)

COO-165 5180
Purdue Research Foundation
LINEAR ELECTRON ACCELERATOR: PROGRESS REPORT. June 15, 1953. 8p. (COO-165)

COO-175 5082
Purdue Research Foundation
RESEARCH WITH HIGH ENERGY ELECTRONS AND X-RAYS PRODUCED BY A 300 MEV SYNCHROTRON: PROGRESS REPORT. June 30, 1953. 36p. (COO-175)

ISC-348 5039
Ames Lab.
SEPARATION OF INDIVIDUAL RARE EARTHS BY LIQUID-LIQUID EXTRACTION FROM MULTICOMPONENT MONAZITE RARE EARTH NITRATES. 1. UNDILUTED TRIBUTYL PHOSPHATE AND CONCENTRATED AQUEOUS RARE EARTH NITRATE SYSTEMS AT LOW ACID CONCENTRATIONS. J. Bochinski, M. Smutz, and F. H. Spedding. May 27, 1953. 34p. (ISC-348)

ISC-360 5024
Ames Lab.
A NEW METHOD OF PURIFYING α, β, γ, δ-TETRAPHENYL-PORPHINE. J. H. Priesthoff and C. V. Banks. [June 30, 1953] 5p. (ISC-360)

ISC-362 5040
Ames Lab.
THE SEPARATION OF ADJACENT RARE EARTHS WITH ETHYLENEDIAMINE-TETRAACETIC ACID BY ELUTION FROM AN ION-EXCHANGE RESIN. F. H. Spedding, J. E. Powell, and E. J. Wheelwright. [July 8, 1953] 6p. (ISC-362)

KAPL-916 5047
Knolls Atomic Power Lab.
TABLES OF SELF-EQUILIBRATING FUNCTIONS AND SOME APPLICATIONS. G. Horvay and J. S. Born. May 8, 1953. 137p. (KAPL-916)

NYO-671 5163
Johns Hopkins Univ.
NEUTRONS FROM $Be^9(d,n)B^{10}$; [FINAL REPORT]. C. D. Swartz and J. S. Pruitt. Feb. 1953. 28p. (NYO-671)

NYO-3093 5063
Columbia Univ.
[INTERFACIAL TENSIONS OF MOLTEN METAL-MOLTEN SALT SYSTEMS: BISMUTH AGAINST KCl-LiCl EUTECTIC MIXTURE.] [N. S. Shaikhmahmud and C. F. Bonilla.] [June 1, 1953.] 10p. (NYO-3093)

NYO-3403 5088
Institute of Industrial Research, Syracuse Univ.
STRUCTURE AND COMPOSITION OF AIR SHOWER CORES. Harold L. Kasnitz and Kurt Sitte. June 5, 1953. 48p. (NYO-3403)

NYO-3404 5089
Institute of Industrial Research, Syracuse Univ.
DEVELOPMENT OF AIR SHOWERS IN THE ATMOSPHERE. Kurt Sitte and Don L. Stierwalt, [Institute of Industrial Research,] Syracuse Univ. and Irving L. Kofsky, Smith Coll. June 5, 1953. 29p. (NYO-3404)

NYO-3409 5215
Spectroscopy Lab., Mass. Inst. of Tech.
PRECISION MEASUREMENT OF WAVELENGTHS WITH ECHELLE SPECTROGRAPHS. George R. Harrison, Sumner P. Davis, and Hugh J. Robertson. June 1, 1953. 36p. (NYO-3409)

NYO-3466 5055
New York Univ.
CORROSION INHIBITION IN ACID SOLUTION; [FINAL REPORT.] Cecil V. King and Edward Hillner. June 1953. 18p. (NYO-3466)

NYO-3590 5204
Laboratory for Nuclear Science [and Engineering], Mass. Inst. of Tech.
BETA-DECAY ENERGETICS AND NUCLEAR SHELL STRUCTURE. Charles D. Coryell. [June 1953] 17p. (NYO-3590)

NYO-3656 5086
Carnegie Inst. of Tech.
A PRECISE DETERMINATION OF e/m FOR 375 MEV PROTONS. Donald J. Grove. May 1953. 175p. (NYO-3656)

NYO-3734 5202
Massachusetts Inst. of Tech.
X-RAY STUDY OF RADIATION DAMAGE. B. E. Warren. June 30, 1953. 4p. (NYO-3734)

NYO-3770 5041
Pittsburgh Univ.
ACETYLACETONE AS AN ANALYTICAL EXTRACTION AGENT. 2. EXTRACTION OF ALUMINUM, GALLIUM, AND INDIUM. John F. Steinbach and Henry Freiser. Issued June 1953. 12p. (NYO-3770)

NYO-3771 5023
Pittsburgh Univ.
ANALYTICAL ASPECTS OF THE REACTIONS OF 2-(2-PYRIDYL)-BENZIMIDAZOLE AND 2-(2-PYRIDYL)-IMIDAZOLINE WITH IRON(II). Joseph L. Walter and Henry Freiser. Issued June 1953. 20p. (NYO-3771)

NYO-3827 5188
Rochester Univ.
THE SCATTERING OF 40 MEV POSITIVE PIONS BY HYDROGEN. J. P. Perry and C. E. Angell. July 6, 1953. 8p. (NYO-3827)

NYO-3828 5122
Rochester Univ.
RELATIVISTIC TWO-BODY EQUATION AND THE NEW TAMM-DANCOFF METHOD. Abraham Klein. July 9, 1953. 6p. (NYO-3828)

NYO-4016 5005
Atomic Energy Medical Research Project, Western Reserve Univ.
EFFECT OF ANTIBIOTIC DOSAGE ON MORTALITY FROM WHOLE BODY X-IRRADIATION. Gordon E. Gustafson and Simon Koletsky. Issued June 25, 1953. 10p. (NYO-4016)

NYO-4017 4991
Atomic Energy Medical Research Project, Western Reserve Univ.
THE EFFECT OF SURGERY ON DOGS FOLLOWING WHOLE BODY X-IRRADIATION. Gordon E. Gustafson and Frank A. Cebul. Issued June 25, 1953. 22p. (NYO-4017)

NYO-6157 5015
Pittsburgh Univ.
STUDIES OF NaCl-KCl SOLID SOLUTIONS. 2. EXPERIMENTAL ENTROPIES OF FORMATION AND A COMPARISON OF CERTAIN THERMODYNAMIC PROPERTIES WITH VALUES CALCULATED FROM WASASTJERNA'S THEORY.

W. T. Barrett and W. E. Wallace. July 1, 1953. 14p. (NYO-6157)

NYO-6218 5164
Yale Univ.
ENERGY LEVELS IN A^{38} FROM THE Cl(α,p) REACTION. A. Z. Kranz and W. W. Watson. [June 11, 1953] 7p. (NYO-6218)

NYO-6219 5165
Yale Univ.
PROTONS FROM THE DEUTERON BOMBARDMENT OF Kr^{84} AND Kr^{86}. G. W. Wheeler, R. B. Schwartz, and W. W. Watson. [1952] 10p. (NYO-6219)

ORNL-1560 5205
Oak Ridge National Lab.
1-3 γ-CORRELATION WITH MIXTURES AND POLARIZATION. R. K. Osborn and M. E. Rose. Issued July 22, 1953. 12p. (ORNL-1560)

RME-3050 5056
Columbia Univ.
FRACTURE PATTERN OF THE ZUNI UPLIFT; FINAL REPORT. Arthur K. Gilkey. June 1953. 40p. (RME-3050)

RME-4018 5057
Division of Raw Materials, AEC
RESULTS OF EXPLORATION AT THE COPPER KING MINE, LARIMER COUNTY, COLORADO. Raymond C. Derzay and Kenneth E. Baker. Issued Apr. 1953. 20p. (RME-4018)

RME-4019 5058
Division of Raw Materials, AEC
INVESTIGATION OF SUBSURFACE SORAD METHODS, TEMPLE MOUNTAIN, SAN RAFAEL DISTRICT, UTAH. David N. Hinckley. Issued Sept. 2, 1952. 26p. (RME-4019)

RME-4021 5059
Division of Raw Materials, AEC
RECONNAISSANCE IN THE WESTERN PART OF THE TRANS-PECOS REGION OF TEXAS. Jonathan P. Hadfield, Jr. Issued Jan. 23, 1953. 15p. (RME-4021)

SO-2029 5064
General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; EIGHTEENTH QUARTERLY REPORT. J. H. Hollomon and D. Turnbull. July 5, 1953. 11p. (SO-2029; Progress Report 35; RL-927)

SO-2511 5065
General Electric Research Lab.
DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; FIFTEENTH QUARTERLY REPORT. J. H. Keeler. July 5, 1953. 12p. (SO-2511; Progress Report 16; RL-928)

SO-3253 5042
Rensselaer Polytechnic Inst.
THE SEPARATION OF ISOTOPES BY DIFFUSION-DISTILLATION; TOPICAL REPORT. C. W. Williamson. July 1, 1953. 64p. (SO-3253)

UCLA-262 5009
Atomic Energy Project, Univ. of Calif., Los Angeles
A METHOD FOR PARTICLE SIZE DETERMINATIONS OF DUSTS COLLECTED ON MEMBRANE FILTERS. W. C. Burke, Jr. Issued July 6, 1953. 16p. (UCLA-262)

UCRL-2161 5142
Radiation Lab., Univ. of Calif., Berkeley
EMPLOYMENT OF THE SPIRAL ORBIT SPECTROMETER TO MEASURE PION PRODUCTION RATIOS BY PROTON BOMBARDMENT. Ryokichi Sagane. May 26, 1953. 26p. (UCRL-2161)

UCRL-2164 5111
Radiation Lab., Univ. of Calif., Berkeley
MULTI-CHANNEL PULSE HEIGHT ANALYSER. Harry R. Bowman and Robert E. Thomas. Apr. 3, 1953. 5p. (UCRL-2164)

UCRL-2185 5182
Radiation Lab., Univ. of Calif., Berkeley
CONCERNING THE ABSOLUTE CALIBRATION OF THE BERKELEY SYNCHROTRON BEAM. Nelson Jarmie. Apr. 15, 1953. 5p. (UCRL-2185)

UCRL-2186 4988
Radiation Lab., Univ. of Calif., Berkeley
THE PATH OF PHOTONS IN PHOTOSYNTHESIS. 1. ROLE OF THIOCTIC ACID IN THE HILL REACTION. D. F. Bradley and Melvin Calvin. Apr. 1953. 32p. (UCRL-2186)

UCRL-2207 5112
Radiation Lab., Univ. of Calif., Berkeley
20 KILOVOLT DELTA FUNCTION GENERATOR. Harry G. Heard. May 14, 1953. 18p. (UCRL-2207)

UCRL-2210 5166
Radiation Lab., Univ. of Calif., Berkeley
YIELD OF CHARGED PIONS AT 180° TO THE BEAM BY 340 MEV PROTONS ON CARBON (thesis). Stanley Lee Leonard. May 1953. 56p. (UCRL-2210)

UCRL-2226 5128
Radiation Lab., Univ. of Calif., Berkeley
INEXPENSIVE GAMMA DETECTOR. Donald R. Cone and David W. Garbellano. May 18, 1953. 16p. (UCRL-2226)

UCRL-2230 5212
Radiation Lab., Univ. of Calif., Berkeley
CRYSTAL STRUCTURES OF RARE EARTH OXYCHLORIDES. D. H. Templeton and Carol H. Dauben. May 25, 1953. 9p. (UCRL-2230)

UCRL-2236 5189
Radiation Lab., Univ. of Calif., Berkeley
ELASTIC SCATTERING OF 190 MEV DEUTERONS BY PROTONS. Owen Chamberlain and Martin O. Stern. June 3, 1953. 34p. (UCRL-2236)

UCRL-2238 5183
Radiation Lab., Univ. of Calif., Berkeley
MAGNETIC DEFLECTOR FOR THE BEVATRON. Byron T. Wright. June 4, 1953. 13p. (UCRL-2238)

UCRL-2245 5143
Radiation Lab., Univ. of Calif., Berkeley
MEASUREMENTS OF MESON MASSES AND RELATED QUANTITIES. F. M. Smith, W. Birnbaum, and Walter H. Barkas. June 1953. 4p. (UCRL-2245)

UCRL-2256 5144
Radiation Lab., Univ. of Calif., Berkeley
SOLUTIONS OF THE MESON-NUCLEON EQUATION IN THE ADIABATIC LIMIT. R. Arnowitt and S. Deser. June 29, 1953. 4p. (UCRL-2256)

UR-232 5102
Atomic Energy Project, Univ. of Rochester
COLLAGEN-CRYSTAL RELATIONSHIPS IN BONE. 2. ELECTRON MICROSCOPE STUDY OF BASIC CALCIUM PHOSPHATE CRYSTALS. M. L. Watson and R. A. Robinson. May 18, 1953. 42p. (UR-232)

UR-260 4992
Atomic Energy Project, Univ. of Rochester
QUARTERLY TECHNICAL REPORT [FOR] JANUARY 1, 1953 THRU MARCH 31, 1953. May 29, 1953. 68p. (UR-260)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE-EL/M-79 5123
Atomic Energy Research Establishment, Harwell, Berks (England)
THE USE OF THE PROBE UNIT TYPE 1014a WITH HALOGEN-QUENCHED GEIGER-MÜLLER COUNTERS. C. D. Florida and C. N. Davey. June 8, 1953. 9p. (AERE-EL/M-79)

AERE-EL/R-1171 5116
Atomic Energy Research Establishment, Harwell, Berks (England)
A SIMPLE MASS SPECTROMETER FOR ANALYSIS OF STABLE TRACERS. E. H. Cooke-Yarborough and M. C. B. Russell. Apr. 16, 1953. 20p. (AERE-EL/R-1171)

AERE-GP/R-1129 5124
Atomic Energy Research Establishment, Harwell, Berks (England)
THE SYSTEM OF STEREOSCOPIC PHOTOGRAPHY AND REPROJECTION USED WITH THE HARWELL 18 INCH DIFFUSION CLOUD CHAMBER. H. C. Whitby. Mar. 1953. 17p. (AERE-GP/R-1129)

AERE-I/R-1135 5179
Atomic Energy Research Establishment, Harwell, Berks (England)
THE ROUTINE PRODUCTION OF ZIRCONIUM-TRITIUM AND ZIRCONIUM-DEUTERIUM TARGETS. W. J. Arrol, E. J. Wilson, and C. Evans. Apr. 14, 1953. 11p. (AERE-I/R-1135)

AERE-M/R-1040A 5053
Atomic Energy Research Establishment, Harwell, Berks (England)
THE INHIBITION OF GAS PHASE REACTIONS OF ZIRCONIUM BY ANODIC OXIDE FILMS. PART 2. J. J. Polling and A. Charlesby. May 27, 1953. 14p. (AERE-M/R-1040A)

JENER-Pub.-6 5125
Joint Establishment for Nuclear Energy Research (Norway)
CALCULATION OF RANGE/ENERGY RELATIONS ESPECIALLY IN PHOTOGRAPHIC EMULSIONS. M. Bogaardt. 1953. 68p. (JENER-Pub.-6)

ML-202 5181
Microwave Lab., Stanford Univ.
EXTERNAL MAGNETIC FOCUSING DEVICES FOR THE MARK 3 ACCELERATOR. J. A. McIntyre, R. L. Kyhl, and W. K. Panofsky. July, 1953. 48p. (ML-202)

NBS-2558 5083
National Bureau of Standards
EDDY-CURRENT MUTUAL-INDUCTANCE TRANSDUCERS WITH HIGH-CONDUCTIVITY REFERENCE PLATES. Horace M. Joseph and Nathan Newman. June 15, 1953. 81p. (NBS-2558)

NBS-2598 5126
National Bureau of Standards
ALPHA-RAY MEASUREMENTS PROGRAM. G. M. Temmer and J. M. Wyckoff. June 30, 1953. 27p. (NBS-2598)

NP-4654 5084
Chicago Univ.
NATURAL TRITIUM ASSAY, ROUTINE METHOD FOR ABSOLUTE ASSAY OF BETA RADIOACTIVITY, AND THE REACTIONS OF NEGATIVE π MESONS WITH ELEMENTARY BROMINE: FINAL REPORT. W. F. Libby. Dec. 1, 1952. 110p. (NP-4654)

NP-4657 5214
University of Southern Calif.
ISOTOPE SHIFT AND NEW FINE STRUCTURE IN NEUTRAL ATOMIC OXYGEN. John R. Holmes and Lee W. Parker. June 15, 1953. 67p. (NP-4657; Technical Report 5)

NP-4658 5054
Engineering Research Inst., Univ. of Mich.
AN INVESTIGATION OF INTERGRANULAR OXIDATION IN STAINLESS STEEL; QUARTERLY PROGRESS REPORT. C. A. Siebert, M. J. Sinnott, and R. E. Keith. June 1953. 9p. (NP-4658; Quarterly Progress Report 2)

NP-4659 5149
Indiana Univ.
INDIANA CONFERENCE ON NUCLEAR SPECTROSCOPY AND THE SHELL MODEL [HELD AT INDIANA UNIVERSITY ON MAY 14–16, 1953]; SUMMARY REPORT. 50p. (NP-4659)

NP-4664 5115
Committee on Nuclear Science, National Research Council
STATUS REPORT ON STANDARIZATION OF RADIONUCLIDES IN THE UNITED STATES. George G. Manov. July 1953. 22p. (NP-4664; Preliminary Report 13)

NP-4665 5085
Laboratory for Insulation Research, Mass. Inst. of Tech.
TABLES OF DIELECTRIC MATERIALS. VOL. 4. Jan. 1953. 156p. (NP-4665; Technical Report 57)

NP-4669 5121
Section Technique de l'Armee. Groupement Atomique (France)
THE QUANTIZING OF THE KLEIN-GORDON FIELD. PART 1. (LA QUANTIFICATION DU CHAMP DE KLEIN-GORDON. PREMIERE PARTIE.) Claude A. Klein. 1952–53. 41p. (NP-4669)

NRL-4145 5186
Naval Research Lab.
PENETRATION OF GAMMA RADIATION THROUGH IRON. L. A. Beach, R. B. Theus, and W. R. Faust. Apr. 9, 1953. 15p. (NRL-4145)

NRL-4165 5187
Naval Research Lab.
EFFECT OF ANGLE OF INCIDENCE UPON PENETRATION OF GAMMA RADIATION. E. H. Bebbs, R. H. Vogt, and W. R. Faust. Apr. 16, 1953. 13p. (NRL-4165)

NRL-4189 5127
Naval Research Lab.
POTENTIAL INSIDE A GEIGER TUBE: INTERIM REPORT. Herbert B. Rosenstock and Norman M. Gailar. June 26, 1953. 6p. (NRL-4189)

TEI-314 5060
Geological Survey
A MINERALOGIC STUDY OF CHURN DRILL CUTTINGS FROM A WELL THROUGH THE BONE VALLEY FORMATION, HILLSBOROUGH COUNTY, FLORIDA. Robert Berman. Feb. 1953. 20p. (TEI-314)

TEI-327 5061
Geological Survey
HYDROXYL SUBSTITUTION IN THORITE AND ZIRCON. Clifford Frondel. May 1953. 20p. (TEI-327)

TEI-329 5109
Geological Survey
A NOTE ON THE TRANSIENT GAS FLOW PROBLEM. A. Y. Sakakura. June 1953. 12p. (TEI-329)

U-23136 5066
Battelle Memorial Inst.
DEVELOPMENT OF SUBSTITUTES FOR STAINLESS STEEL IN SPECIFIC APPLICATIONS; QUARTERLY PROGRESS REPORT COVERING THE PERIOD OF APRIL 1, 1952 TO JUNE 30, 1952. H. A. Robinson, H. O. McIntire, and G. K.

Manning. July 10, 1952. 24p. (U-23136; Quarterly Progress Report 4)

WAL-401/16 5067
Watertown Arsenal Lab.
MICROSTRUCTURAL CHARACTERISTICS OF SEVERAL TITANIUM AND TITANIUM ALLOY SPECIMENS. Mary R. Norton. May 24, 1950. 31p. (WAL-401/16)

WAL-401/27 5068
Watertown Arsenal Lab.
A COMPARISON OF THE MECHANICAL PROPERTIES OF COMMERCIALLY PURE TITANIUM WITH THOSE OF AN 0.80% CARBON-TITANIUM ALLOY AND A 7% MANGANESE-TITANIUM ALLOY TOGETHER WITH SOME OBSERVATIONS OF MICROSTRUCTURE. M. R. Norton and W. P. Clancy. June 12, 1951. 29p. (WAL-401/27)

WAL-401/89-9 5069
Smith, A. O., Corp.
RESEARCH AND DEVELOPMENT FOR WELDING TITANIUM AND TITANIUM ALLOYS, FOR THE PERIOD APRIL 1, 1952 TO MAY 1, 1952. F. W. Schmitz and John J. Chyle. May 5, 1952. 14p. (WAL-401/89-9)

WAL-401/89-12 5070
Smith, A. O., Corp.
RESEARCH AND DEVELOPMENT FOR WELDING OF TITANIUM AND TITANIUM ALLOYS, FOR THE PERIOD JULY 1, 1952 TO AUGUST 1, 1952. John J. Chyle. Aug. 13, 1952. 20p. (WAL-401/89-12)

WAL-401/89-13 5071
Smith, A. O., Corp.
RESEARCH AND DEVELOPMENT FOR WELDING OF TITANIUM AND TITANIUM ALLOYS, FOR THE PERIOD AUGUST 1, 1952 TO SEPTEMBER 1, 1952. John J. Chyle. Sept. 9, 1952. 26p. (WAL-401/89-13)

WAL-401/89-14 5072
Smith, A. O., Corp.
RESEARCH AND DEVELOPMENT FOR WELDING OF TITANIUM AND TITANIUM ALLOYS FOR THE PERIOD SEPTEMBER 1, 1952 TO OCTOBER 1, 1952. John J. Chyle. 24p. (WAL-401/89-14)

WAL-401/103-11 5073
Armour Research Foundation
RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT: INTERIM TECHNICAL REPORT [FOR] JANUARY 1–APRIL 30, 1952. H. D. Kessler. 38p. (WAL-401/103-11; U-23305)

WAL-401/107-9 5074
Armour Research Foundation
DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo. INTERIM TECHNICAL REPORT [FOR] FEBRUARY 1, 1952–MAY 31, 1952. W. Rostoker and D. J. McPherson. June 19, 1952. 28p. (WAL-401/107-9; Interim Technical Report 2)

WAL-401/122 5075
Watertown Arsenal Lab.
INTERSTITIAL HOLES IN THE TITANIUM HCP LATTICE. B. Bovarnick. Aug. 12, 1952. 23p. (WAL-401/122)

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 Sept. 30, 1953 No. 18A

GENERAL

ATOMIC POWER

4985
ENGINEERING AND TECHNICAL PROBLEMS OF ATOMIC POWER. Walter H. Zinn. Combustion 24, No. 12, 49-52 (1953) June.

A discussion is presented of fuel supply and probable costs, reactor types, moderator and structural materials, coolants, corrosion problems, shielding, and what has been accomplished to date in the actual production of power. (auth)

RESEARCH PROGRAMS

4986
[Los Alamos Scientific Lab.]
PAPERS PRESENTED AT THE CONFERENCE ON ATOMIC ENERGY EDUCATION [HELD] AT THE UNIVERSITY OF NEW MEXICO [ON] OCTOBER 17 AND 18, 1952. (AECU-2537)

Papers presented at the Conference on Atomic Energy Education at the Univ. of N. Mex. on the following subjects are reproduced: Possible Uses of Nuclear Power; Atomic Blast Effects on Buildings and Structural Dynamics; Uranium Exploration; Separation of U Isotopes; Industrial Power from Nuclear Energy; Radioisotopes for Industrial Research and Application. (J.E.D.)

BIOLOGY AND MEDICINE

4987
Brookhaven National Lab.
GROUP TRANSFER AS AN ENZYMATIC SUBSTITUTION MECHANISM. Daniel E. Koshland, Jr. [1953] 50p. (BNL-1502)

The enzymatic reactions which catalyze the substitution of a group Y for a group X in the molecule BX have been considered as a single category because of their similarity to each other and to their chemical analogs. Examples of enzymes in this category are the hydrolases, the phosphorylases, and the group-transfer enzymes. By analogy to the chemical mechanisms it is postulated that the enzymatic substitutions proceed by displacement mechanisms in which a single covalent bond is formed as another single covalent bond is broken. By delineating these mechanisms in physical-chemical terms, criteria for characterizing the nature of the enzyme-substrate intermediates can be evaluated. From these it can be seen that the similarities between different sub-groups may be greater than between different enzymes in the same subgroup. Thus, the shift from a phosphatase to a transphosphorylase or from a glycosidase to a transglycosidase may involve merely a change in specificity, whereas two phosphorylases may react through entirely different kinds of enzyme-substrate intermediates. It is further suggested that, as in the case of their chemical analogs, a few simple mechanisms may suffice to explain the mode of action of the enzymes which catalyze the wide variety of substitution reactions. (auth)

4988
Radiation Lab., Univ. of Calif., Berkeley
THE PATH OF PHOTONS IN PHOTOSYNTHESIS. 1. ROLE OF THIOCTIC ACID IN THE HILL REACTION. D. F. Bradley and Melvin Calvin. Apr. 1953. 32p. (UCRL-2186)

Conditions have been realized under which the Hill reaction by cellular chloroplasts of Scenedesmus is stimulated by prior incubation with synthetic 6-thioctic acid. The conditions for stimulation are senstive functions of the oxidant concentration, 6-thioctic acid concentration, light intensity, suspension density, chlorophyll content of the algae, culture conditions, and incubation condition. The observed stimulatory effects are consistent with the proposal that 6-thioctic acid is the primary quantum converter in photosynthesis. (auth)

RADIATION EFFECTS

4989
Brookhaven National Lab.
THE EFFECT OF CHRONIC GAMMA RADIATION ON MUTATIONS IN MAIZE. 1. ENDOSPERM MUTATIONS. 2. EFFECTS ON POLLEN. W. Ralph Singleton. [1953] 59p. (BNL-1419)

Chronic γ radiation from a Co^{60} source was used to study mutation rates and the percent of abnormal pollen produced in maize. Plants were grown in concentric circles around the source, making it possible to study the effects of markedly different doses of radiation on the mutation rate. Mutation rates in the microspore were determined. Data are summarized, and comparison is made with accepted spontaneous mutation rates. (C.H.)

4990
Brookhaven National Lab.
CYTOGENETIC EFFECTS OF X-RAY AND THERMAL NEUTRON IRRADIATION ON SEEDS OF BARLEY. Richard S. Caldecott, B. H. Beard, and C. O. Gardner; Nebraska Univ. and Brookhaven National Lab. [1953] 37p. (BNL-1425)

A comparison was made between the effects of irradiating dormant seeds of barley with x rays and thermal neutrons as measured by survival and the frequency of chromosomal aberrations and mutations. Cytogenetic changes are described and illustrated. In terms of the production of both chromosomal aberrations and mutations it was calculated that $\sim 3.0 \times 10^8$ thermal neutrons/cm^2 are equivalent to 1 r from x radiation. (C.H.)

4991
Atomic Energy Medical Research Project, Western Reserve Univ.
THE EFFECT OF SURGERY ON DOGS FOLLOWING WHOLE BODY X-IRRADIATION. Gordon E. Gustafson and Frank A. Cebul. Issued June 25, 1953. 22p. (NYO-4017)

Resection of a segment of ileum was well tolerated in dogs receiving 200 or 300 r whole-body x irradiation 20 hr

prior to surgery. Mortality in 18 pairs of dogs was 39% for animals receiving irradiation alone and 44% for the group receiving irradiation and surgery. On the first post-operative day the white blood count of operated dogs was increased 41% above the mean preirradiation count, while in control dogs the white count during the same period was decreased 37%. The surgical wounds healed remarkably well in the operated dogs. Wound infection did not occur in those dogs having skin closures of subcuticular suture. The most common pathological finding in dogs dying following irradiation was a profound bacterial pneumonitis. (auth)

4992

Atomic Energy Project, Univ. of Rochester

QUARTERLY TECHNICAL REPORT [FOR] JANUARY 1, 1953 THRU MARCH 31, 1953. May 29, 1953. 68p. (UR-260)

Design of a semiportable air-pumping system for aerosol sampling is described. Details are presented of a small chamber for producing test atmospheres. A two-fold increase in the urinary excretion of adrenal cortical steroids was observed in pigs following exposure to 1000 r whole-body x radiation. Results are summarized from studies of the mortality of dogs resulting from repeated exposures to total-body and sub-total x irradiation with and without abdominal shielding. A method is described for determining the critical energy of fabrics (threshold of damage) by measuring their persistence time under thermal radiation. Intravenous injections of Piromen failed to alter the response of dogs to LD_{50} exposures to x radiation. Results are summarized from preliminary studies of the effect of antibiotic therapy on radiation injuries of dogs. The use of whole blood in the treatment of the acute radiation syndrome in dogs was reviewed, and from the results it was concluded that compatible whole blood does not affect the clinical course except possibly when given immediately after x irradiation occurs. It was demonstrated by studies of the turnover of α-C^{14}-acetate and P^{32} that components of the stroma of the circulating red cells of the rabbit undergo a rapid metabolic turnover, the components studies having a biological half life of about 3 days. A simple procedure is described for the determination of specific catabolites of radioactive precursors in the intact rat. The method consists of injecting intraperitoneally into a 24-hr-fasted rat a solution containing a small amount of the radioactive material and a large dose of its suspected catabolite. Part of the large dose is subsequently excreted into the urine, carrying with it some of the like radioactive material derived from the radiometabolite. A summary of results from studies of the renal excretion of Ca in the dog is included. (For preceding period see UR-242.) (C.H.)

4993

TOXICITY OF RADIOSTRONTIUM IN MONKEYS. G. M. Edington, J. M. Judd, and A. H. Ward. Nature 172, 122-3 (1953) July 18.

Preliminary studies showed a higher toxicity and greater retention of Sr^{90} in monkeys than in other species of animals. Data on 8 monkeys given injections of 0.5 to 2.0 mc/kg Sr^{90} in equilibrium with Y^{90} indicated all animals apparently died from anemia after a survival time of from 13 to 56 days. (C.H.)

4994

EXPERIMENTAL ACUTE RADIODERMATITIS FOLLOWING BETA IRRADIATION. V. HISTOPATHOLOGICAL STUDY OF THE MODE OF ACTION OF THERAPY WITH ALOE VERA. C. C. Lushbaugh and D. B. Hale. Cancer 6, 690-9(1953) July.

Rabbits irradiated locally on the back with 14,000 and 28,000 rep of β radiation from Sr^{90} were treated with fresh whole leaf of Aloe vera and a commercially available ointment made from these leaves. The gross and microscopic morphological changes in the skin resulting from the radiation alone were compared with those in the irradiated skin treated with Aloe. Treatment was found to hasten both the degenerative and reparative phases of the lesion so that complete healing of an ulcer caused by 28,000 rep of β radiation was accomplished within two months of treatment, while the untreated ulcerations were still not completely healed more than four months after irradiation. It was concluded that A. vera contains substances that are stimulatory both to the delayed development and delayed healing of ulcerative radiodermatitis and that because of the growing modern importance of this injury further investigation of the action of A. vera should be pursued. (auth)

4995

THE OCCURRENCE OF PLASMA CELLS AFTER IONIZING IRRADIATION IN DOGS. Frederick J. Wohlwill and Walter W. Jetter. Am. J. Pathol. 29, 721-9(1953) July-Aug.

Histopathologic examination of dogs subjected to chronic whole-body x irradiation demonstrated replacement of lymphocytes in lymphoid tissue by cells of a type that meets some, or all, of the morphological criteria of the plasma cell. (C.H.)

4996

COMPARATIVE EFFECTS OF TOTAL BODY RADIATION, NITROGEN MUSTARD, AND TRIETHYLENE MELAMINE ON THE HEMATOPOIETIC SYSTEM OF TERMINAL CANCER PATIENTS. R. Kenneth Loeffler, Vincent P. Collins, and George A. Hyman. Science 118, 161-3(1953) Aug. 7.

The comparative effects of total-body x radiation, nitrogen mustard, and triethylene melamine on the hematopoietic system were studied in a group of 10 terminal cancer patients. Data are presented in tabular form. Results indicated a tolerance to dosages of total-body x radiation of 100 to 150 r. (C.H.)

4997

EXPERIMENTAL ACUTE RADIODERMATITIS FOLLOWING BETA IRRADIATION. I. ITS PATHOGENESIS AND REPAIR. C. C. Lushbaugh, J. B. Storer, and D. B. Hale. Cancer 6, 671-7(1953) July.

The sequence of events is described in the pathogenesis and repair of ulcerative radiodermatitis following exposure of the abdominal skin of rats to β particles from Sr^{90} and P^{32}. (C.H.)

4998

CELLULAR CHANGES ACCOMPANYING ACUTE AND SUB-ACUTE X-IRRADIATION DEATH OF THE HAMSTER. II. THE ENDOCRINES. Roberts Rugh, Barnet Levy, and Lottie Sapadin. J. Cellular Comp. Physiol. 41, 359-74 (1953) June.

The effects of acute and sub-acute radiation exposures on the thyroid, parathyroid, pituitary, adrenal, and pancreas glands in the hamster are reported. It was concluded that the endocrine glands are relatively radioresistant, although parts of some of the glands were found to be radiosensitive. Cellular changes in endocrine glands accompanying acute and sub-acute x-irradiation death are described and illustrated. (C.H.)

4999

EXPERIMENTAL ACUTE RADIODERMATITIS FOLLOWING BETA IRRADIATION. IV. CHANGES IN RESPIRATION AND GLYCOLYSIS. C. C. Lushbaugh and D. B. Hale. Cancer 6, 686-9(1953) July.

Determinations of the rate of O_2 uptake and anaerobic glycolysis were made by the usual manometric methods of Warburg, using skin of rats killed at intervals after local exposure to 14,000 and 28,000 rep of β radiation from radioactive Sr. It was found that after an immediate transitory depression there was a marked stimulation of O_2 up-

take and glycolysis, the most rapid rates being found on the second day after radiation. These rates declined to normal by the fourth to sixth days and, as necrosis developed, fell far below normal. The onset of healing after the tenth day was accompanied by a rise in the glycolytic rate. These changes were interpreted as being indicative of a severe disturbance in normal enzymatic processes occurring immediately after the radiation. Destruction of sulfhydryl enzymes or other regulatory systems was considered as a possible explanation for this unusual stimulatory activity. Further studies are needed in order to determine the exact nature of the alteration in enzymatic processes and the relationship of these changes to the subsequent morphological damage and failure of healing. (auth)

5000

EXPERIMENTAL ACUTE RADIODERMATITIS FOLLOWING BETA IRRADIATION. II. THE INHIBITION OF FIBROPLASIA. C. C. Lushbaugh and J. B. Storer. Cancer 6, 678-82(1953) July.

The failure of fibroplasia to occur throughout skin damaged by irradiation and the failure of the subsequent ulcer to be healed by the usual method of granulation-tissue production were studied in rats irradiated locally with β radiation. Surgical incisions were made through the normal and irradiated skin of the abdominal wall, and the cellular reaction to this additional trauma was studied histologically. It was found that, while a normal cellular exudate developed promptly, fibroblasts failed to appear and proliferate in the irradiated area. If the surgical incision was made before the area was irradiated, the fibroblasts that began to proliferate were arrested and underwent changes that resulted in the formation of giant anomalous forms. These changes were remarkably restricted to the irradiated area and their extent through the thickness of the abdominal wall was found to be dependent upon the amount of β radiation that has been delivered. The results of this experiment were felt to indicate that the indolence of ulcerative radiodermatitis was based in large measure upon this inhibition of fibroplasia by radiation. (auth)

5001

EXPERIMENTAL ACUTE RADIODERMATITIS FOLLOWING BETA IRRADIATION. III. THE CHANGES IN WATER, FAT, AND PROTEIN CONTENT. C. C. Lushbaugh and D. B. Hale. Cancer 6, 683-5(1953) July.

The water, fat, and protein content of rat skin exposed to a large single dose of β radiation were determined at periods of one hr and 2, 4, 6, 9, 11, 13, 15, and 16 days after exposure. The increase in water and decrease in fat and protein content previously described by others as being typical of healing did not reach a maximum in the irradiated skin until the thirteenth day after exposure. This delay in biochemical changes correlates well with the slow development of morphological signs of radiation damage and repair. When the data were recalculated on a dry-weight basis and the fat content kept constant, the protein content was found to rise in a manner consistent with morphological evidence of healing. In contrast to surgical wounds, the changes in protein content of areas of ulcerative radiodermatitis are remarkably slow and of low magnitude. (auth)

5002

EFFECTS OF OXYGEN CONCENTRATION ON X-RAY-INDUCED MITOTIC INHIBITION IN LIVING CHORTOPHAGA NEUROBLASTS. Mary Esther Gaulden, Marjorie Nix, and Jack Moshman. J. Cellular Comp. Physiol. 41, 451-70 (1953) June.

An investigation is reported of the effects of O concentration on radiation-induced mitotic inhibition in grasshopper neuroblasts. Neuroblast mitosis in vivo was not affected by O tension in the absence of radiation under the experimental conditions used. The depth to which mitosis was depressed by x rays was affected only slightly if at all by the O present during irradiation. It is concluded that the influence of O tension on the response of these cells to radiation involves more than merely a change in the amount of injury produced by the radiation. (C.H.)

RADIATION HAZARDS AND PROTECTION

5003

VENTILATION FOR RADIOACTIVE WORK. BALANCING. OPERATION. MAINTENANCE. W. W. McIntosh. Heating, Piping, Air Conditioning 25, No. 7, 98-102(1953) July.

The basic problems to be considered in the design, operation, and maintenance of an efficient ventilation system for buildings wherein radioactive materials are handled or processed are outlined. (L.M.T.)

5004

EFFECT OF PITUITARY EXTRACTS ON RADIATION-INDUCED TESTICULAR ATROPHY IN RATS. John B. Storer and Phyllis Sanders. Proc. Soc. Exptl. Biol. Med. 83, 259-62(1953) June.

A study was made on the effect of gonadophysin, an extract from sheep pituitaries which contains both follicle-stimulating and luteinizing hormone, on radiation-induced testicular atrophy in rats. Adult and immature male rats were given single exposures of 500 r total-body x radiation and 800 r of x radiation to the testes only in 3 fractionated doses, respectively. Gonadophysin was injected twice weekly for the first 4 to 6 weeks or from the 8th to 16th week following radiation exposures to evaluate the effectiveness of this agent on testicular atrophy and regeneration. Gonadophysin was found to increase slightly the degree of testicular atrophy and to inhibit testicular regeneration in rats. (auth)

RADIATION SICKNESS

5005

Atomic Energy Medical Research Project, Western Reserve Univ.

EFFECT OF ANTIBIOTIC DOSAGE ON MORTALITY FROM WHOLE BODY X-IRRADIATION. Gordon E. Gustafson and Simon Koletsky. Issued June 25, 1953. 10p. (NYO-4016)

Rats were given varying doses of terramycin hydrochloride beginning 72 hr and ending 1 to 4 hr prior to x irradiation. The highest dosage level (200 mg/rat/day) was the most effective in lowering mortality. It is probable that larger doses of antibiotics are required in the x irradiation syndrome than are required for the treatment of other diseases. (auth)

5006

CONTROL OF THE POSTIRRADIATION HEMORRHAGIC STATE BY PLATELET TRANSFUSIONS. M. C. Woods, Frances N. Gamble, J. Furth, and R. R. Bigelow. Blood 8, 545-53(1953) June.

The appearance of large numbers of erythrocytes in the lymph of dogs and rats exposed to massive doses of ionizing radiation is partially or completely prevented by transfusion of concentrated suspensions of intact, homologous blood platelets. The quantitative correlation of the blood platelet and lymph erythrocyte levels is a more sensitive index of the hemorrhagic state than the anatomic changes seen at autopsy. Hemorrhage occurs in dogs and rats after the platelet level of the blood drops below 50,000/mm^3. Passage of erythrocytes from the blood to lymph is retarded almost immediately after transfusion and the lymph erythrocyte levels are markedly reduced. (auth)

5007

THE ACUTE RADIATION SYNDROME. L. H. Hempelmann.

Med. Radiography Phot. 29, No. 2 and 3, 42-6(1953). (cf NSA 6-2273)

The history of a case of acute radiation syndrome which developed following exposure to a large dose of mixed neutron and γ radiation resulting from an uncontrolled nuclear reaction is presented. (C.H.)

RADIOTHERAPY

5008

CELLULAR CHANGES IN EFFUSIONS FOLLOWING INTRACAVITARY ADMINISTRATION OF COLLOIDAL Au^{198} IN HUMAN BEINGS. Vernie A. Stembridge, Ralph M. Kniseley, and Gould A. Andrews. J. Lab. Clin. Med. 41, 760-6(1953) May.

Pleural and ascitic fluids associated with malignant neoplasms have been studied in an effort to clarify the mechanisms involved in intracavitary radiogold therapy. Following treatment, malignant cells persist in a significant proportion of cases. The inflammatory cellular response to the injection of the radioactive Au is quite variable. Phagocytes containing Au pigment are found with regularity at various intervals following therapy, being seen as early as one day and usually present during the first four to five weeks after treatment. Subsequently, they are infrequently found. (auth)

TOXICOLOGY STUDIES

5009

Atomic Energy Project, Univ. of Calif., Los Angeles

A METHOD FOR PARTICLE SIZE DETERMINATIONS OF DUSTS COLLECTED ON MEMBRANE FILTERS. W. C. Burke, Jr. Issued July 6, 1953. 16p. (UCLA-262)

A method for size determinations of dust collected on membrane filters has been developed. Results indicate that the reproducibility and accuracy are good. The membrane filter is dissolved in an organic solvent, and the resultant suspension is analyzed turbidimetrically. Determinations by this method are rapid and easily carried out. (auth)

TRACER APPLICATIONS

5010

Brookhaven National Lab.

MECHANISM OF HYDROLYSIS OF ADENOSINETRIPHOSPHATE CATALYZED BY LOBSTER MUSCLE. D. E. Koshland, Jr., and Edith Clarke. [1953] 40p. (BNL-1415)

The hydrolysis of adenosinetriphosphate catalyzed by washed lobster muscle strips was studied in O^{18} labeled water. The low O^{18} content of the ADP produced demonstrates that cleavage of the terminal P-O bond occurs in the hydrolytic reaction. It is concluded that the ATPase and kinase mechanisms involve a nucleophilic attack on the terminal P atom. The inorganic phosphate produced in the hydrolysis contained a high content of O^{18} which could not have arisen by synthesis and hydrolysis of high-energy phosphate compounds and must have been the result of an exchange reaction. The O^{18} and P^{32} contents of the unhydrolyzed ATP and the O^{18} content of inorganic phosphate after incubation with lobster muscle could be correlated by postulating a local site or an intermediate compound which was not in rapid equilibrium with the external inorganic phosphate pool. The mechanisms of the exchange reaction and the ATP cleavage reactions are discussed. (auth)

5011

Brookhaven National Lab.

STUDIES WITH RADIOPHOSPHORUS IN DROSOPHILA. 4. THE DISTRIBUTION AND TURNOVER OF PHOSPHORUS IN THE TISSUES OF D. MELANOGASTER. Robert C. King. [1953] 24p. (BNL-1416)

The distribution, concentration, and turnover of P in the tissues of Drosophila were studied utilizing tracer techniques. Data are presented in tabular form on the distribution of P^{32} in various tissues of totally labeled adult flies of both sexes. (C.H.)

5012

MODIFICATION OF THE DISTRIBUTION AND EXCRETION OF RADIOISOTOPES BY CHELATING AGENTS. Hiram Hart and Daniel Laszlo. Science 118, 24-5(1953) July 3.

Modifications in the distribution and excretion of intravenously injected La^{140} by the administration of Ca-ethylenediaminetetraacetate (EDTA) and La-EDTA are reported. Results are compared with results from previously reported decontamination studies using Fe^{59} and Y^{91} and distribution studies using La-EDTA and La chloride. Since La removal by EDTA was found to decrease with time, it is suggested that EDTA may be used as an investigative tool as well as for removal of metals and radioisotopes from the body. (C.H.)

CHEMISTRY

5013

Radiation Lab., Univ. of Calif., Berkeley

CHEMISTRY DIVISION QUARTERLY REPORT [FOR] DECEMBER 1952, JANUARY AND FEBRUARY 1953. Apr. 13, 1953. Decl. June 9, 1953. 49p. (AECD-3504; UCRL-2179)

Progress is reported on the following studies: mass assignments of rare-earth isotopes; crystal structure of cyclobutane; products of He-ion bombardment of alcohols; rare-earth products of Ta spallation and fission; spallation products of Ag; decay of Am^{242}; radiation decomposition of some C^{14}-labeled compounds; synthesis of labeled organic compounds; synthesis of C^{14}-labeled peptides; isotope effect in the pinacol rearrangement; Na acetate metabolism by pantothenic-acid-deficient rats; adenine metabolism; glucose space in the dog; S-containing components of photosynthetic organisms; quantitative assay for thioctic acid; flow system for kinetic studies in photosynthesis; degradation of ribulose and sedoheptulose; spectrum of MgO; preparation of finely divided Ag_2S and Ag; and preparation of Ti metal. (For previous report in series see UCRL-2069). (K.S.)

5014

Ames Lab.

A NEW METHOD OF PURIFYING α, β, γ, δ-TETRAPHENYLPORPHINE. J. H. Priesthoff and C. V. Banks. [June 30, 1953] 5p. (ISC-360)

α, β, γ, δ-Tetraphenylporphine was prepared by the reaction of pyrrole with benzaldehyde in a sealed tube. It was found that the yield could be increased to about 10% if the Zn complex salt was prepared. The Zn was subsequently removed by the action of 6N HCl. Although it was reported that the reaction product could be filtered and purple crystalline tetraphenylporphine obtained, this was found not to be the case in any one of the twenty reactions carried out. The product of the reaction was a black, tarry mass and could not be filtered. Although the tarry by-product could be extracted with acetone and crystalline Zn tetraphenylporphine obtained, about 5 g of the complex were lost per liter of acetone used. Therefore, a new method was developed in which the Zn complex was decomposed with acid and the free-base-tar solution chromatographed on

activated alumina. The free-base eluate was concentrated and chromatographed on Magnesol, yielding pure tetraphenylporphine. (auth)

5015
Pittsburgh Univ.
STUDIES OF NaCl-KCl SOLID SOLUTIONS. 2. EXPERIMENTAL ENTROPIES OF FORMATION AND A COMPARISON OF CERTAIN THERMODYNAMIC PROPERTIES WITH VALUES CALCULATED FROM WASASTJERNA'S THEORY. W. T. Barrett and W. E. Wallace. July 1, 1953. 14p. (NYO-6157)

Experimental entropies of formation of NaCl-KCl solid solutions are obtained from the solid solubility curve and calorimetrically determined heats of formation by reversal of the method of common tangents. These data and the heats of formation are compared with results computed using Wasastjerna's theory assuming (a) a random distribution and (b) a partially ordered solution. The observed heats of formation correspond with (b), but the entropies deviate positively from the ideal entropies of formation, whereas the existence of local order requires a negative deviation. The entropy agrees fairly well with that computed assuming random mixing when the effect of the large number of Schottky defects is included. (auth)

5016
DETERMINATION OF TRANSPORT NUMBERS OF CATIONS AND ANIONS IN A PURE MOLTEN SALT. S. Karpachev and S. Pal'Guev. Translated from Zhur. Fiz. Khim. 23, 942-52(1949). 19p. (AEC-tr-1551)

5017
AN ISOTOPE EFFECT DURING OZONIZATION. William A. Bonner and Clair J. Collins. J. Am. Chem. Soc 75, 3693-4(1953) Aug. 5.

When stilbene-α-C^{14} was ozonized fractionally in the presence of 2,4-dinitrophenylhydrazine sulfate, a series of samples of radioactive benzaldehyde 2,4-dinitrophenylhydrazone was obtained representing differentially increasing stages of completion of ozonization. Assay of these showed a diminished C^{14} content in samples obtained at the outset of ozonization and an augmented C^{14} content in samples obtained from the latter stages. The results indicate a normal isotope effect of 4.2%, occurring during initial molozonide formation. (auth)

5018
A STUDY OF THE KINETICS OF THE REACTION BETWEEN NITROGEN DIOXIDE AND ALCOHOLS. A. M. Fairlie, Jr., J. J. Carberry, and J. C. Treacy. J. Am. Chem. Soc. 75, 3786-8(1953) Aug. 5.

The reaction $2NO_2 + ROH = HNO_3 + RONO$ has been studied photometrically at pressures from one to ten mm, in apparatus having a small surface to volume ratio. Initially the forward rate is given by the expression: $dp_{NO_2}/dt = k \cdot (p_{NO_2})^2(p_{ROH})$. The constant k and the equilibrium constant at 25° have been evaluated for five of the lower paraffin alcohols. For any given batch run, values of "k" computed from the above equation were found to increase with extent of reaction indicating an autocatalytic effect. Meager temperature data on methanol indicate a negative temperature coefficient for the reaction as given above. A mechanism involving a simple reaction and a concurrent catalytic reaction dependent on a trace secondary product or on surface effects are tentatively postulated. (auth)

5019
THE BOROHYDRIDE OF LITHIUM; METHOD OF PREPARATION; FORMATION OF A COMPLEX WITH DIOXANE. Raymond Paul and Nicole Joseph. Bull. soc. chim. France, 758-61(1953) July-Aug. (In French)

A description is given for the preparation of BH_4Li based upon the double decomposition of BH_4K and LiCl in tetrahydrofuran. A solution of BH_4Li is obtained which can be used as such or from which the solid product can be extracted. The preparation of a BH_4Li-dioxane complex is given. The complex is more stable than BH_4Li and can replace it in its applications. (tr-auth)

5020
THE CHEMISTRY OF THORIUM. IV. SOME OBSERVATIONS ON THORIUM HYPOPHOSPHATE. Therald Moeller and Gladys Quinty Dawson. J. Am. Chem. Soc. 75, 3572-4(1953) July 20.

Reaction of Th ion with dihydrogen hypophosphate ion in aqueous solution has been shown by direct analysis of the product and by both conductance and pH titration data to yield the normal hypophosphate, ThP_2O_6. A method is described for obtaining the normally highly gelatinous material as a dry, free-flowing powder, which is still amorphous to x rays. Freshly precipitated Th hypophosphate has been found to adsorb both hypophosphate and Th ions. The extent of adsorption of the former has been followed by a radiometric technique. Adsorption of the latter in HCl solution has been found to peptize Th hypophosphate to clear sols which can be dialyzed and can be sedimented in the ultracentrifuge. Th ion in 0.5N acid has been shown to sediment also in high force fields. (auth)

5021
THE CARBON ISOTOPE EFFECT IN THE ACID HYDROLYSIS OF UREA. John A. Schmitt and Farrington Daniels. J. Am. Chem. Soc. 75, 3564-6(1953) July 20.

Urea containing approximately 1% each of C^{13} and C^{14} was subjected to acid hydrolysis at 100°C in phosphate buffer. The relative rates of decomposition were determined by mass spectrometric analysis of the CO_2 evolved at different time intervals during the reaction. The C^{12}-urea is hydrolyzed 10.1% faster than C^{14}-urea and 5.5% faster than C^{13}-urea. The ratio of these values agrees with theory. (auth)

ANALYTICAL PROCEDURES

5022
Brookhaven National Lab.
COLORIMETRIC DETERMINATION OF CYANIDE IN THE PRESENCE OF FERROCYANIDE. Virginia D. Hogan and Everett R. Johnson. [1953] 6p. (BNL-1501)

A method has been developed for the determination of cyanide in the presence of dilute ferrocyanide, in the concentration ratio ferrocyanide/cyanide = 100 to 200. The method consists essentially of adding $Fe_2(SO_4)_3$ in concentrated H_2SO_4 to the solution to be analyzed and sparging the solution with air. The HCN is collected in dilute KOH, and the resulting KCN solution is analyzed. The accuracy of the method is only slightly better than ±10%. (auth)

5023
Pittsburgh Univ.
ANALYTICAL ASPECTS OF THE REACTIONS OF 2-(2-PYRIDYL)-BENZIMIDAZOLE AND 2-(2-PYRIDYL)-IMIDAZOLINE WITH IRON(II). Joseph L. Walter and Henry Freiser. Issued June 1953. 20p. (NYO-3771)

The compounds 2-(2-pyridyl)-benzimidazole and 2-(2-pyridyl)-imidazoline were found to react with several metallic ions including Fe(III), Fe(II), Cu(I), Cu(II), Co(II), and Hg(II). With these ions, except Hg, the reagents gave color reactions. Most notable was that with Fe(II) with which deep red-purple-colored complexes were formed. These complexes were studied spectrophotometrically and found to have max. absorbances at 490 mμ for 2-(2-pyridyl)-benzimidazole at pH 5.7 and 560 mμ for 2-(2-pyridyl)-imidazoline at pH 9.0. The molar extinction coefficients for the 2-(2-pyridyl)-benzimidazole and 2-(2-pyridyl)-imidazoline are 3800 and 7800, respectively. The Fe com-

plexes could also be extracted with isoamyl alcohol, thus increasing the sensitivity of the color reaction. The relative stability order of the metal complexes of these reagents, determined spectrophotometrically, was different from the usual metal stability order. (auth)

5024
RAPID METHOD FOR THE DETERMINATION OF TRACE AMOUNTS OF COBALT IN NICKEL ELECTROLYTES AND IN CATHODIC NICKEL. M. N. Chepik. Translated from Zavodskaya Lab. 15, 1470-2(1949). 3p. (AEC-tr-1541)

5025
SPECTROPHOTOMETRIC DETERMINATION OF NIOBIUM IN THE PRESENCE OF TITANIUM. G. Charlot. Chim. anal. 35, 51-3(1953) Mar. (In French)

Consideration of several methods for the determination of Nb in the presence of Ti and Ta has led to the use of spectrophotometry for highest precision. Preparation of the sample in an H_2SO_4-H_3PO_4 medium for Nb-Ti determinations and a tartaric acid medium for Nb-Ta determinations is described. Absorption characteristics are given for Nb, Ti, and Ta. (K.S.)

5026
SPECTROCHEMICAL DETERMINATION OF MAGNESIUM, IRON, SILICON, AND MANGANESE IN TITANIUM METAL. H. A. Heller and R. W. Lewis. Anal. Chem. 25, 1038-42 (1953) July.

Spectrochemical methods for the determination of Mg, Fe, Si, and Mn, the 4 major impurity elements found in ductile Ti, are reported. Discussions of the apparatus, procedure, and reproducibility are included. Data concerning the reproducibility concentration range are presented as follows: Mg, 0.04 to 0.17%; Fe, 0.03 to 0.20%; Si, 0.02 to 0.12%; Mn, 0.01 to 0.05%. The same techniques, with appropriate modifications, should also find application in the analysis of Ti alloys. (J.A.G.)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

5027
ELEMENT ANALOGS IN THE PERIODIC SYSTEM. E. P. Ozhegov. Zhur. Obshcheĭ Khim. 23, 177-80(1953) Feb. (In Russian)

The mass difference between analogs in the second and third period is 16, between the fourth and fifth 44 to 48, and between the sixth and seventh 88 to 90. By comparison with analogs, the principal isotopes, their mass, type of decay, and approximate half lives of new elements can be deduced. These properties of Bk and Cf are tabulated. (J.S.R.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5028
A PERTURBATING FACTOR ON THE KINETICS OF THE HOMOGENEOUS HYDROGEN DEUTERIUM EXCHANGE REACTION. C. Boato, G. Careri, A. Cimino, E. Molinari, and G. G. Volpi. Nuovo cimento (9) 10, 993-4(1953) July 1. (In Italian)

The thermal homogeneous exchange reaction $H + D \rightleftharpoons HD$ was investigated using a Nier-type mass spectrometer. A progressive increase in the rate of exchange was observed even after prolonged outgassing at 950°C. Diffusion of air into the quartz reaction vessel appeared to be the cause for the irreproducibility. Enclosing the reaction vessel in a quartz jacket at a pressure of 10^{-4} mm of Hg seemed to permit outgassing and produce reproducible results. (J.S.R.)

5029
DIFFERENCE IN VISCOSITY OF ORTHO- AND PARA-DEUTERIUM AT LOW TEMPERATURES. E. W. Becker, R. Misenta, and O. Stehl. Phys. Rev. 91, 414(1953) July 15.

Ortho-D_2 has a greater viscosity than para-D_2. It remains unexplained why the kinematic effect expected in quantum-mechanical theory from the different symmetry properties of the eigenfunctions does not occur. (L.M.T.)

FLUORINE AND FLUORINE COMPOUNDS

5030
THE ACTION OF ELEMENTARY FLUORINE UPON ORGANIC COMPOUNDS. XVIII. A NEW TYPE OF REACTOR AND THE MILD FLUORINATION OF CARBON DISULFIDE. Edward A Tyczkowski and Lucius A. Bigelow. J. Am. Chem. Soc. 75, 3523-6(1953) July.

A new type of metal-packed direct-fluorination reactor incorporating a concentric tube burner designed from a study of F diffusion flames has been built and operated. It has been shown by direct comparison to produce a very mild fluorination reaction in which both cleavage and polymerization appear to be reduced. The new reactor has been applied to the mild fluorination of CS_2 which has resulted in the isolation of the new and interesting perfluoro compound $SF_5CF_2SF_5$. This was accompanied by the new $SF_3CF_2SF_5$ and CF_3SF_3, as well as an unusually pure sample of S_2F_{10}, and a variety of additional cleavage products. (auth)

MOLECULAR STRUCTURE

5031
Brookhaven National Lab.
NOTE ON A NITROGEN MOLECULE CALCULATION. Max Wolfsberg. [1952] 12p. (BNL-1493)

Recent calculations of the binding energy of the N molecule carried out by Kopineck are examined by means of molecular orbital calculations. The Hellmann-Kopineck procedure of omitting certain permutations in a valence-bond procedure is investigated. It is concluded that the Kopineck calculations should not be used as an argument favoring the 9.8-ev value for the binding energy (D_0^0) of the N molecule. (auth)

RADIATION CHEMISTRY

5032
Brookhaven National Lab.
THE RADICAL PAIR YIELD OF IONIZING RADIATION IN SULFURIC ACID SOLUTIONS. Everett R. Johnson and Jerome Weiss. [1953] 19p. (BNL-1503)

Ceric sulfate solutions (10^{-3}M in 0.8N H_2SO_4) with and without added gases were irradiated with hard x rays and Co^{60} γ rays. In the presence of CO and H_2 the yield of Ce reduced is equal to twice that found in the presence of air, N_2, or He. The rate of CO_2 formation from 0.8N H_2SO_4 solutions containing CO was obtained and found to be equal to 2.54 molecules/100 ev absorbed. It is believed that this represents the radical pair yield from these solutions. (auth)

5033
DEGRADATION OF POLYMERS BY γ RAYS AND NEUTRONS. L. A. Wall and M. Magat. J. chim. phys. 50, 308-16(1953) May. (In French)

The degradation of solid polymers by irradiation in a pile and the degradation of polymers in solution irradiated by γ rays have been studied with the aid of the viscosimetric method. It was found in the first case that by varying the structure of the polymers either an augmentation or a diminution of the molecular weights can be obtained. It is also shown that, according to the type of polymer, the intrinsic measured viscosity can be modified by dissolving it in solvents containing inhibitors. This is considered proof of the existence in the solid polymer after irradiation of immobilized free radicals. The presence of O is necessary to the degradation when the solutions of high polymers are irradiated by γ rays. In that case an after effect is observed

which can be eliminated by the addition of an inhibitor following the period of irradiation. (tr-auth)

RADIATION EFFECTS

5034

IONIZATION IN LIQUIDS DUE TO ALPHA PARTICLES. E. W. T. Richards. Proc. Phys. Soc. (London) A66, 631-7(1953) July.

The ionization current produced by Po α particles in liquid hexane has been studied using a collimated beam so that it has been possible to determine the direction of the α particles with respect to the collecting electrostatic field. Measurements of the ionization current have been made with various collecting field strengths, and experiments were conducted in which the attempts were made to measure the specific ionization. The ion currents measured were of the same order of magnitude as those obtained by earlier experimenters, but no dependence on the angle between the direction of the α particles and the field was observed. This was in contradiction to results as calculated using Jaffé's columnar theory. The experimental values of the specific ionization do not conform to the Bragg curve as in the case of gases, but all the experimental results obtained are consistent with a calculation assuming that the only ions which can be collected are formed by δ rays at some distance from the α-particle track. (auth)

5035

IRRADIATION OF POLYMERS BY HIGH-ENERGY ELECTRONS. E. J. Lawton, A. M. Bueche, and J. S. Balwit. Nature 172, 76-7(1953) July 11.

The effects of high-energy electrons on the solubility, swelling, gas evolution, and physical properties of a large number of polymers were investigated. The polymers investigated fell into two classes, those that became degraded and those that became cross-linked as a result of irradiation. The radioinduced changes in the properties of polyethylene, nylon, and polydimethylsiloxane were investigated in detail. The amount of cross-linking appeared to be proportional to the amount of irradiation. The physical properties and solubility were changed. The efficiencies for cross-linking were found to vary widely from polymer to polymer. (C.H.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

5036

THE HEAT OF COMBUSTION OF LANTHANUM. Elmer J. Huber, Jr., and Charles E. Holley, Jr. J. Am. Chem. Soc. 75, 3594-5(1953) July 20.

The method involves the determination of the heat evolved from burning a weighed sample of the metal in an O bomb calorimeter at 25 atm. pressure. The energy equivalent of the calorimeter was determined from the heat of combustion of standard benzoic acid and also was determined electrically. The completeness of combustion products with 6N HCl and measuring the amount of H evolved from any unburned metal present. (auth)

SEPARATION PROCEDURES

5037

Oak Ridge National Lab.

A COUNTERCURRENT SOLID-LIQUID CONTACTOR FOR CONTINUOUS ION EXCHANGE. I. R. Higgins and J. T. Roberts. [1952] 15p. (AECU-2546)

A continuous countercurrent ion-exchange contactor has been developed which retains the high-throughput feature of the conventional fixed bed and gains the advantage of countercurrent flow. It can be adapted to many solid-liquid mass-transfer processes, such as silica-gel adsorption and ore leaching as well as ion exchange. Solutions flow against a packed bed, with pressure drop being the only limitation on throughput. Intermittently the solution flows are interrupted momentarily to move hydraulically the resin bed in slug flow. (auth)

5038

Brookhaven National Lab.

THE PREPARATION OF CHROMIUM-51 OF HIGH SPECIFIC ACTIVITY. Garman Harbottle, Brookhaven National Lab. and Alfred G. Maddock, Radiochemical Lab., Cambridge (England). [1953] 7p. (BNL-1438)

A method for the preparation of Cr^{51} of high purity utilizing the Szilard-Chalmers reaction in K_2CrO_4 is described. The active Cr is separated in the trivalent form. The determination of absolute disintegration rate of Cr^{51} and factors influencing the yield and specific activity are discussed. (J.E.D.)

5039

Ames Lab.

SEPARATION OF INDIVIDUAL RARE EARTHS BY LIQUID-LIQUID EXTRACTION FROM MULTICOMPONENT MONAZITE RARE EARTH NITRATES. 1. UNDILUTED TRIBUTYL PHOSPHATE AND CONCENTRATED AQUEOUS RARE EARTH NITRATE SYSTEMS AT LOW ACID CONCENTRATIONS. J. Bochinski, M. Smutz, and F. H. Spedding. May 27, 1953. 34p. (ISC-348)

Rare earths may be separated from each other by extracting aqueous rare earth nitrate solutions with undiluted tributyl phosphate without using HNO_3 or salting-out agents. Separation factors increase with increasing rare earth concentration and are almost independent of the composition of the rare earth nitrate mixture. At equilibrium, the ratio of the total rare earth solutes in the tributyl phosphate to the total rare earths in the aqueous phase is a function of the amount of rare earths present and virtually independent of the composition of the rare earth mixture. If the concentration of the rare earths in the extractor is kept high by refluxing the rare earth solutes in the product streams, it is possible to make very significant separations in only a few stages. Under these conditions, the total concentration of solutes present in adjacent stages remains constant and simple calculation methods can be used to determine optimum operating conditions. (auth)

5040

Ames Lab.

THE SEPARATION OF ADJACENT RARE EARTHS WITH ETHYLENEDIAMINE-TETRAACETIC ACID BY ELUTION FROM AN ION-EXCHANGE RESIN. F. H. Spedding, J. E. Powell, and E. J. Wheelwright. [July 8, 1953] 6p. (ISC-362)

Rare-earth separation by citrate elution and ethylenediaminetetraacetic acid (EDTA) fractionation involving ion exchange are described. Preliminary runs indicate the latter method to be very efficient in separating adjacent rare earths. In this method enough EDTA is added to complex only part of the rare-earth mixture. The EDTA complexes more strongly with rare earths whose stability constants are greater. This mixture is passed through an ion-exchange bed which is in the ammonium cycle, the exchanger acting only as a filter. The heavier rare earths which are more strongly complexed pass through the column, while the uncomplexed ions, mostly lighter rare earths, adsorb on the resin. With a single operation this method allows the separation of a complex rare-earth mixture into fractions which contain only a few adjacent rare earths. (J.E.D.)

5041

Pittsburgh Univ.

ACETYLACETONE AS AN ANALYTICAL EXTRACTION

AGENT. 2. EXTRACTION OF ALUMINUM, GALLIUM, AND INDIUM. John F. Steinbach and Henry Freiser. Issued June 1953. 12p. (NYO-3770)

The extraction characteristics of Al, Ga, and In from aqueous solutions with acetylacetone have been determined. The relation between the shape and position of the extraction curves and such properties of the acetylacetone chelates as their stabilities and distribution coefficients is examined, and the usefulness of such curves in predicting the feasibility of analytical separations and determinations is indicated. A general discussion of the factors which must be controlled in obtaining equilibrium extraction curves is included. (auth)

5042

Rensselaer Polytechnic Inst.

THE SEPARATION OF ISOTOPES BY DIFFUSION-DISTILLATION; TOPICAL REPORT. C. W. Williamson. July 1, 1953. 64p. (SO-3253)

A survey of the literature on the development of the general theory of diffusion, the application of the diffusion process to separation of mixtures of gases and separation of isotopes, and the proposed methods for calculating diffusion coefficients in binary and multicomponent systems are included in the introduction of this work. The theoretical discussion includes the equations necessary to carry out the actual calculation of diffusion coefficients. It also includes tables of calculated diffusion coefficients from which it is possible to calculate the relative effectiveness of light and heavy gases when they are used as diffusion media in a diffusion process. The general discussion of the diffusion-distillation method gives the necessary requirements of a system to work effectively in the separation of isotopes or liquid mixtures. The section of the design of the diffusion-distillation system includes a discussion of the design of each section of the system and the reason the system was so designed. It also includes a cross section of the experimental apparatus. The experimental section of this work includes the procedure followed in preparing the apparatus for an experimental run and the experimental conditions of each of the runs completed. The discussion and conclusions include the experimental results and a comparison of these results with calculated theoretical results. It also includes a discussion of the process including an explanation of the decrease of experimental results below the calculated theoretical values. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

5043

SPECTROPHOTOMETRIC STUDY OF Np(V) OXALATE COMPLEXES. D. M. Gruen and J. J. Katz. J. Am. Chem. Soc. 75, 3772-6(1953) Aug. 5.

A spectrophotometric study has shown that the complexes $NpO_2C_2O_4^-$ and $NpO_2(C_2O_4)_2^{=}$ exist in aqueous solution. Their association constants have been estimated in solutions having an ionic strength of 0.5. The heat of formation for the first complex is 0.0 ± 0.3 kcal. (auth)

URANIUM AND URANIUM COMPOUNDS

5044

COMPLEXES OF URANIUM(VI) WITH HYDROGEN PEROXIDE. J. Corpel. Bull. soc. chim. France, 752-4(1953) July–Aug. (In French)

In a neutral or slightly acid solution, U gives, with H_2O_2, a slightly soluble compound $UO_4 \cdot 2H_2O$ or $UO_3 \cdot H_2O_2$ in which the ratio U/H_2O_2 is equal to one. In an acid solution the compound dissolves to yield the uranyl cation and H_2O_2; the complex does not exist. In an alkaline solution it dissolves to give a complex anion which can be symbolized, in the most simple manner, by UO_5H^- or UO_5^{--}, according to the pH. For the anion the ratio U/H_2O_2 is independent of the pH and remains equal to one. (tr-auth)

5045

CRYSTALLINE VARIETIES OF UO_3. P. Perio. Bull. soc. chim. France, 776-7(1953) July–Aug. (In French)

The crystal parameters of a UO_3 orthorhombic crystal obtained at elevated temperatures are tabulated. The spectra is quite complex, and the space group has not been determined. By slow evolution (2 yr) in air at room temperature a supplementary phase was found. The x-ray spectrum indicates a quadratic system. After exposure to air at 500°C for 48 hr the phase disappears. The parameters of this system are tabulated. (tr-auth)

ENGINEERING

5046

Brookhaven National Lab.

AN INSULATED UNION FOR METAL TUBING. Edward G. Reilly. [1953] 3p. (BNL-1422)

An insulated union for metal tubing is described which is useful in transferring gases at high pressure across high-voltage potentials. It consists of a hollow-threaded stud of Kel-F plastic (polytrifluorochloroethylene), each end of which is threaded into metal coupling nuts. Grooves are machined at each end for "O" rings, which are used to effect a gas-tight seal. (L.M.T.)

5047

Knolls Atomic Power Lab.

TABLES OF SELF-EQUILIBRATING FUNCTIONS AND SOME APPLICATIONS. G. Horvay and J. S. Born. May 8, 1953. 137p. (KAPL-916)

The behavior of rectangular strips under self-equilibrating edge loads is analyzed. This report extends earlier studies (G. Horvay, J. Appl. Mechanics 20, 87(1953)) to the problem of narrow rectangles, where self-equilibrating normal or shear stresses occur on a long side. Solutions for the expressions derived are given in graphic and tabular form. (K.S.)

MATERIALS TESTING

5048

Johns-Manville Corp.

THERMAL INSULATION DEVELOPMENT: PROGRESS REPORT. S. Speil. June 10, 1953. 10p. (AECU-2603; Progress Report 6)

Thermal-conductivity data and heat-loss calculations are presented for LK-61 pipe-insulation material. Application of the insulation by conventional lagging methods and by covering with an independent chrome-steel jacket are described. The latter method is recommended for the extreme conditions encountered in the SIR Mark A reactor compartment. (C.H.)

VACUUM SYSTEMS

5049

A LEAK CONTROL TUBE. J. Morrison. Rev. Sci. Instr. 24, 546-7(1953) July.

A leak control tube which can be used in low-pressure studies to change the conductance of the pumping impedance is described. The tube has a Kovar collar sealed to 7052 glass, and a stainless-steel plate $\frac{3}{16}$ in. thick with 4 holes of different diam. is brazed to the collar. Attached to this stainless-steel plate are two upright pieces which support a threaded Mo rod in quartz bearings. The rod, which is

driven by an external magnetic field acting on a block of cold-rolled steel fastened on its end, moves a small stainless-steel plate across the holes to control the leak. The whole assembly is mounted in a Pyrex glass envelope tubulated at each end. The tube has withstood many hours of baking at temperatures of 400 to 475°C without loss of motion of the moving plate. (L.M.T.)

5050
A MODIFICATION TO THE VANE VALVE. Rollon O. Bondelid. Rev. Sci. Instr. 24, 546(1953) July.

A vacuum vane valve developed at Los Alamos utilizes a metal vane sliding across an "O" ring to provide the vacuum seal (Wahl, et al., Rev. Sci. Instr. 23, 379(1952)). This construction results in a compact, low-impedance, easily operable valve. However, it is reported that the valve shows a small leak when tested with a helium leak detector. Occasionally the "O" ring is forced out of its groove; this occurs infrequently and not in all valves. A modification which corrects these difficulties has been incorporated in a valve of this type and is described. (auth)

5051
VACUUM COLD TRAP. Glenn H. Miller. Rev. Sci. Instr. 24, 549-50(1953) July.

A cold trap is described which is advantageous where a collimated light or particle beam is present in a vacuum system. The construction is such that the beam passes through an opening in the trap. The large area of the trap gives a relatively high pumping speed. (auth)

5052
TEFLON INSERT MAKES NEEDLE VALVE VACUUM TIGHT. Lauren J. Rueger. Rev. Sci. Instr. 24, 551(1953) July.

Insertion of a thin-walled, tapered, Teflon gasket into the valve-seat insert of a vacuum needle valve overcomes the problem of excessive wear of the stainless-steel surfaces which normally occurs with repeated usage. (L.M.T.)

MINERALOGY, METALLURGY, AND CERAMICS

CORROSION

5053
Atomic Energy Research Establishment, Harwell, Berks (England)
THE INHIBITION OF GAS PHASE REACTIONS OF ZIRCONIUM BY ANODIC OXIDE FILMS. PART 2. J. J. Polling and A. Charlesby. May 27, 1953. 14p. (AERE-M/R-1040A)

Experiments have been conducted to determine the effect of electrolytically formed oxide films on the subsequent gas uptake by Zr at high temperatures. At 435°C there is an appreciable decrease in the rate at which gases enter the system when an electrolytic oxide is present on the surface. If allowance is made for the presence of the initial oxide layer on the anodized specimens, the weight increase-time curve is similar for all specimens. The anodized specimens gain weight at the same rate as non-anodized specimens after these have been heated in air for a time sufficient to produce the same oxide thickness as was obtained electrolytically. It is concluded that there is no difference between oxide layers obtained thermally or electrolytically; moreover, the weight increase on heating in air up to 600°C appears to be due to surface oxidation alone and not to dissolution of atmospheric gases in the metal, at least for films up to 10^4 A in thickness. (auth)

5054
Engineering Research Inst., Univ. of Mich.
AN INVESTIGATION OF INTERGRANULAR OXIDATION IN STAINLESS STEEL; QUARTERLY PROGRESS REPORT. C. A. Siebert, M. J. Sinnott, and R. E. Keith. June 1953. 9p. (NP-4658; Quarterly Progress Report 2)

Oxidation tests of 100 hours duration on stainless steel have been carried out at temperatures of 1600, 1700, 1800, and 1900°F at an air flow of 20 fpm, and penetration measurements were made on these specimens. Intergranular penetration varied in depth from 0.0003 in. at 1600°F to 0.003 in. at 1900°F. In general, depth penetration and its standard deviation increase with increasing oxidation temperature. A discussion of metallographic appearances of the penetrating material at different temperatures, particularly at 1800°F, is given. Equipment and procedures used in the investigation are described. (J.A.G.)

5055
New York Univ.
CORROSION INHIBITION IN ACID SOLUTION; [FINAL REPORT.] Cecil V. King and Edward Hillner. June 1953. 18p. (NYO-3466)

Cylinders of Fe, Zn, and Cd were rotated in a highly corrosive solution of acid containing nitrate ion as a depolarizer. Three kinds of inhibitors were added to the solution: dichromate ion plus complexing or chelating agents for metal ions; a wetting or emulsifying agent which is strongly adsorbed; and a reagent which forms a very insoluble precipitate with ferrous and ferric ions. Measurements of the effectiveness of these inhibitors are given. (auth)

GEOLOGY AND MINERALOGY

5056
Columbia Univ.
FRACTURE PATTERN OF THE ZUNI UPLIFT; FINAL REPORT. Arthur K. Gilkey. June 1953. 40p. (RME-3050)

The basic purpose of this study has been to determine the major fracture pattern of the Zuni uplift as a whole and to analyze the results for their bearing upon the origin of the uplift. It was hoped that this fracture information might afford a verdict upon whether the uplift had formed as a horizontally compressed fold or whether it had arisen through passive doming of the rocks by masses rising from below them. Beyond these fundamental objectives was the intention of examining especially closely the fracture pattern of that part of the northeast flank of the uplift where most of the U ore has so far been found, to determine whether it has any structural peculiarities which might prove of use in considering ore possibilities elsewhere. (auth)

5057
Division of Raw Materials, AEC
RESULTS OF EXPLORATION AT THE COPPER KING MINE, LARIMER COUNTY, COLORADO. Raymond C. Derzay and Kenneth E. Baker. Issued Apr. 1953. 20p. (RME-4018)

Uranium mineralization was encountered in the Copper King mine shaft through a vertical distance of 68 ft. The vein explored on the 140 sub-level by a 38-foot drift contained ore-grade material in a zone within 10 ft of the shaft and in a small 5-ft pocket near the east end of the drift. An inclined raise on the 140 sub-level was driven to the 110 level, and ore-grade pitchblende was encountered 3 ft below the 110 level. A 31-ft east drift on the 110 level contained 22 ft of pitchblende ore. Total development below the 70 level consisted of 102 ft of shaft sinking, 81 ft of drifting, 59 ft of raising, and 52 ft of cross-cutting. The wall rock is predominantly pre-Cambrian granite with some schist

inclusions and pegmatites. An amphibole-pyroxene skarn occurs with the sulfide mineralization. The ore deposit consists of two distinct, superimposed types of mineralization, the pre-Cambrian contact metamorphic and the Tertiary mesothermal, with high-temperature oxides and sulfides of Fe, lesser amounts of sulfides of Cu and Zn, and pitchblende with quartz and siderite. Pitchblende occurs as sooty incrustations on fractures; as botryoidal coatings; as hard, semi-vitreous vein-filling material; in pyrite boxwork; and finely disseminated in altered wall rock. Alteration accompanying the U mineralization is rather weak and consists of sericitization and chloritization. The main structural feature of the mine is a 1- to 4-ft steeply dipping fault which strikes northwesterly. Fourteen diamond-drill holes totaling 3001.6 ft were drilled in an effort to discover any additional mineralization along the vertical and lateral extensions of the principal structures. No mineralization of commercial value over a mining width was developed. The best assays were below 0.05% U_3O_8 over a 2-ft width. Drilling established the extension of the main fault, explored secondary structures, and delineated the orebody. A detailed scintillometer survey and reconnaissance was made in the area of the mine, but no significant radiometric anomalies were determined. (auth)

5058

Division of Raw Materials, AEC

INVESTIGATION OF SUBSURFACE SORAD METHODS, TEMPLE MOUNTAIN, SAN RAFAEL DISTRICT, UTAH. David N. Hinckley. Issued Sept. 2, 1952. 26p. (RME-4019)

The subsurface isorad method is an attempt to locate areas favorable for U ores by the use of contour maps which show localities having greater radioactivity. The construction of isorad maps entails the measurement of the area under the curve of a γ-ray log. The figures obtained indicate relative amounts of γ radiation and are used to locate the isorad contours. This work was started at Temple Mountain in the San Rafael Swell area during the spring of 1952. The purpose of this investigation is to determine the most effective and economic hole spacing for subsurface isorad work. The lower 45 ft of the ore-bearing Shinarump conglomerate was divided into three intervals each 15 ft thick. These intervals were considered individually and also as a composite unit. For each interval, 12 isorad maps were constructed based on varying hole patterns. For each pattern a composite isorad map was made combining all three intervals. About 98% of the ore holes fell within the 200 contour on the "base" isorad maps; consequently, this area is considered the "target" area. Study of the maps of each interval shows that this target area can be located most effectively and economically with a hole spacing of 225 to 300 ft. At this spacing, 79 to 83% of the ore holes fall within the 200 contour, which saves 37 to 43% of the holes drilled under present methods not utilizing isorad techniques. A study of the composite isorad maps indicates that similar results could be obtained with a hole spacing of 200 to 275 ft. This spacing would locate 93 to 95% of the ore holes within the 200 contour, with a saving of 12 to 15% of the holes drilled under the present methods not utilizing isorad techniques. (auth)

5059

Division of Raw Materials, AEC

RECONNAISSANCE IN THE WESTERN PART OF THE TRANS-PECOS REGION OF TEXAS. Jonathan P. Hadfield, Jr. Issued Jan. 23, 1953. 15p. (RME-4021)

The Trans-Pecos region of southwest Texas is noted for the production of quicksilver, Pb, Ag, and Cu from its several mining districts. Reconnaissance, which was concentrated in and around these districts, revealed many areas of slightly abnormal radioactivity. Only a few areas, however, showed U mineralization. Northwest-trending faults are the dominant structural features, and these are reflected in the elongation of the highland areas. Slight variations in this northwesterly trend have been caused by overthrust movements from the southwest. Another normal fault set, of northeast strike and steep dip, is evident throughout the region. These latter faults apparently have most directly influenced the localization of the quicksilver, Pb, Ag, and Cu ores in the mining districts. Other minor faults, caused by local adjustments, also have exerted some influence on localization of these ores. The hydrothermal deposits show stratigraphic as well as structural controls. All variations between vein and replacement deposits have been found, but the largest of the Pb-Ag and fluorite deposits are of the latter type. Whereas collapse-breccia and replacement deposits are common to the sedimentary rocks, simple veins are found in igneous and metamorphic rocks. Many of the deposits indicate a low temperature, or epithermal, origin. A few, however, have characteristics approaching those of mesothermal deposits. (auth)

5060

Geological Survey

A MINERALOGIC STUDY OF CHURN DRILL CUTTINGS FROM A WELL THROUGH THE BONE VALLEY FORMATION, HILLSBOROUGH COUNTY, FLORIDA. Robert Berman. Feb. 1953. 20p. (TEI-314)

The mineral constituents of churn-drill cuttings from a well through the Bone Valley formation and into the Hawthorn formation were determined. The weight percent of each mineral is given, as well as a description of the samples and the methods used. In this well the Bone Valley formation is composed largely of montmorillonite with smaller amounts of quartz and apatite. The Hawthorn formation is calcareous and contains more quartz and less clay than the Bone Valley. The quantitative evidence of relative mineral percentages in the two formations does not indicate that the Bone Valley originated by residual concentration of such Hawthorn rock as underlies it. (auth)

5061

Geological Survey

HYDROXYL SUBSTITUTION IN THORITE AND ZIRCON. Clifford Frondel. May 1953. 20p. (TEI-327)

The ill-defined thorite-like minerals thorogummite, nicolayite, hydrothorite, maitlandite, mackintoshite, and hyblite are found to be minor chemical variants of a single phase, for which the name thorogummite has priority. Thorogummite is isostructural with thorite and has virtually the same unit cell dimensions. It differs from thorite in being secondary in origin, being formed by the alteration of primary Th minerals including thorite itself, in occurring as fine-grained aggregates that are not metamict but crystalline, and in containing essential water. Chemically, thorogummite seems to be a hydroxyl-containing variant of thorite, $ThSiO_4$, in which there is a serial substitution of $(OH)_4$ for (SiO_4) with the formula $Th(SiO_4)_{1-x}(OH)_{4x}$. Cyrtolite apparently stands in an analogous relation to zircon. (auth)

5062

RADIUM CONTENTS OF ROCK SPECIMENS FROM KOLAR MINES. V. S. Venkitasubramanian. J. Sci. Ind. Research (India) 12, 267-70(1953) June.

The Ra contents of 27 rock specimens from Kolar Mines have been determined by a method that combines the direct fusion technique of Evans and co-workers with the α-particle counting technique of Curtiss and co-workers. Further improvement in the technique has been made by running the electron-collection chamber in the proportional-counter regime, resulting in improved signal-to-noise ratio and

particle-group resolution. The trend of results in similar to those of Smeeth and Watson. (auth)

METALS AND METALLURGY

5063
Columbia Univ.
[INTERFACIAL TENSIONS OF MOLTEN METAL-MOLTEN SALT SYSTEMS: BISMUTH AGAINST KCl-LiCl EUTECTIC MIXTURE.] [N. S. Shaikhmahmud and C. F. Bonilla.] [June 1, 1953.] 10p. (NYO-3093)

A capillary drop-weight apparatus was constructed which checked the accepted value of the interfacial tension of Hg-H_2O within 5%. The interfacial tension of molten Bi vs. molten KCl-LiCl eutectic mixture was then measured at 700 to 900°F. The interfacial tension was found to be 240 dynes/cm, and independent of temperature over that temperature range. The surface tension against air of the chloride melt was also measured and found to be 118 dynes/cm at 800°F. Antonoff's rule for predicting interfacial tension was shown to yield a value within 4% of the observed one for Bi-eutectic mixture. The spreading coefficient for the eutectic salt on molten Bi is probably positive, but small enough that spreading does not take place appreciably under static conditions. In a single test, the molten salt also did not spread at a Bi-304 stainless steel interface. (auth)

5064
General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; EIGHTEENTH QUARTERLY REPORT. J. H. Hollomon and D. Turnbull. July 5, 1953. 11p. (SO-2029; Progress Report 35; RL-927)

Completed measurements on the effect of dissolved Cu on the self-diffusion coefficient of Ag are reported. The effect of lattice anisotropy on the low-temperature heat capacity of Cu-Au and Au-Ni alloys is summarized. (auth)

5065
General Electric Research Lab.
DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; FIFTEENTH QUARTERLY REPORT. J. H. Keeler. July 5, 1953. 12p. (SO-2511; Progress Report 16; RL-928)

Zr-Al binary alloys were studied by tensile tests at 500°C in A and at –195°C in liquid N_2, by the preparation of several Zr-Al intermetallic compounds, and by the cold-rolling at room temperature of alloys containing up to 10 at.% Al. An aging study of the Zr-Al system was also begun. Preliminary data concerning other Zr binary alloys are included, and additional data concerning the grain-size effect in rolled and annealed crystal-bar Zr are reported. (auth)

5066
Battelle Memorial Inst.
DEVELOPMENT OF SUBSTITUTES FOR STAINLESS STEEL IN SPECIFIC APPLICATIONS; QUARTERLY PROGRESS REPORT COVERING THE PERIOD OF APRIL 1, 1952 TO JUNE 30, 1952. H. A. Robinson, H. O. McIntire, and G. K. Manning. July 10, 1952. 24p. (U-23136; Quarterly Progress Report 4)

Alloys containing 0.5 or 0.8% C; 2, 6, or 10% Cr; and 1.5 to 11% Mn were subjected to heat treatment and drawing tests. A 0.8% C-6% Cr-7.5% Mn alloy withstood a 43% reduction in area. In the austenitic condition no alloy had good drawability. Alloys heat-treated to a pearlitic structure, solution-treated for 6 hr at 2050°F, and H_2O-quenched prior to tempering drew up to 86% but were less promising than low-C Cr-Mn-Fe alloys as a replacement for 18-8 stainless steel. Other heat-treated alloys tempered from the hot-rolled and air-cooled condition were also less promising. A 13% Cr-14.3% Mn-0.08% C alloy was processed to a 0.015-in.-diam. wire; its drawability was slightly inferior to that of Cr-Ni stainless steels but was appreciably better than other Cr-Mn alloys and Hadfield steel. Strength properties of the alloy were equal to those of Cr-Ni stainless steel for similar amounts of cold reduction. Magnetism in the hard-drawn condition appeared excessive. Chemical analyses of liquid-carburized wires of alloys containing 10% Cr and 8% Mn revealed 0.17 to 0.41% C contents for 0.028- to 0.02-in.-diam. sizes, respectively, while 10% Cr-10% Mn alloys revealed 0.17 to 0.23% C contents, respectively. (auth)

5067
Watertown Arsenal Lab.
MICROSTRUCTURAL CHARACTERISTICS OF SEVERAL TITANIUM AND TITANIUM ALLOY SPECIMENS. Mary R. Norton. May 24, 1950. 31p. (WAL-401/16)

Microstructures of Ti, Al-Cr-Ti, and Cr-Fe-Ti alloys are studied. Polishing and etching techniques and structure of swaged iodide Ti rod are discussed. The microstructures are described in detail and in some cases are compared with photomicrographs. (J.E.D.)

5068
Watertown Arsenal Lab.
A COMPARISON OF THE MECHANICAL PROPERTIES OF COMMERCIALLY PURE TITANIUM WITH THOSE OF AN 0.80% CARBON-TITANIUM ALLOY AND A 7% MANGANESE-TITANIUM ALLOY TOGETHER WITH SOME OBSERVATIONS OF MICROSTRUCTURE. M. R. Norton and W. P. Clancy. June 12, 1951. 29p. (WAL-401/27)

Results of notched-bar impact tests, tensile tests, and hardness tests are presented for commercially pure hot-forged bar stocks, high-C (0.80%) hot-forged plate in the as-forged and the annealed condition, and 7% Mn hot-rolled and stabilized plate and warm-rolled and stabilized sheet. Notched-bar impact tests made above and below room temperature and tensile tests performed at room temperature are discussed. Pertinent data on the mechanical properties for the above are presented in tabular form. The microstructures of the 2 binary alloys are recorded and are correlated with mechanical behavior. (J.A.G.)

5069
Smith, A. O., Corp.
RESEARCH AND DEVELOPMENT FOR WELDING TITANIUM AND TITANIUM ALLOYS, FOR THE PERIOD APRIL 1, 1952 TO MAY 1, 1952. F. W. Schmitz and John J. Chyle. May 5, 1952. 14p. (WAL-401/89-9)

Heliarc welding of Ti alloys is studied, with filler-metal strips removed from the respective plate materials. Photomicrographs and data are presented for the welding of 7% Mn-Ti alloy and 4% Al-4% Mn-Ti alloy, in both the as-welded and annealed conditions. (K.S.)

5070
Smith, A. O., Corp.
RESEARCH AND DEVELOPMENT FOR WELDING OF TITANIUM AND TITANIUM ALLOYS, FOR THE PERIOD JULY 1, 1952 TO AUGUST 1, 1952. John J. Chyle. Aug. 13, 1952. 20p. (WAL-401/89-12)

The mechanical tests made on the welds indicated that heat treatment markedly improved the ductility of the welds, as indicated in the results made on the bend specimens made across the welds. The effect of heat treatment on the hardness of the weld and in the heat-affected zone of the parent stock reduces the hardness from the as-welded condition to a marked extent, as shown in the hardness survey data. These tests also indicate that Ti alloy XCM has good weldability and that no difficulties were encountered in making sound welds in this alloy. (auth)

5071
Smith, A. O., Corp.
RESEARCH AND DEVELOPMENT FOR WELDING OF TITANIUM AND TITANIUM ALLOYS, FOR THE PERIOD

AUGUST 1, 1952 TO SEPTEMBER 1, 1952. John J. Chyle. Sept. 9, 1952. 26p. (WAL-401/89-13)

Results are reported from preliminary simple fusion tests on Ti alloys, tests of the mechanical properties of welded Ti alloys, and tests of the effect of heat treatment on Ti alloy weld metal. A description is included of the procedure used in welding Ti alloys. (C.H.)

5072

Smith, A. O., Corp.

RESEARCH AND DEVELOPMENT FOR WELDING OF TITANIUM AND TITANIUM ALLOYS FOR THE PERIOD SEPTEMBER 1, 1952 TO OCTOBER 1, 1952. John J. Chyle. 24p. (WAL-401/89-14)

Metallurgical investigations were carried out on the weld, parent stock, and heat-affected zone of welds made in $\frac{1}{2}$-in. 150A alloy plates using 75A and 150A filler metal. Tensile and bend tests are reported on welds made in $\frac{1}{2}$-in. Rem-Cru 130A and 130B alloys, using filler metal obtained by sawing strips from the parent stock. The all-weld tensile properties of XCM weld metal, which was heat treated as recommended, were determined. Flame-cutting tests on 150A, 130A, and XCM alloys using the oxyacetylene process were carried out, and machinability tests on the flame-cut edges were made. Weldability tests on flame-cut XCM alloy are reported. Results of chemical analyses on various types of Ti alloys and welds are presented. (For preceding period see WAL-401/89-13.) (L.M.T.)

5073

Armour Research Foundation

RESEARCH AND DEVELOPMENT TOWARD IMPROVING TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDITION OF A THIRD COMPONENT: INTERIM TECHNICAL REPORT [FOR] JANUARY 1–APRIL 30, 1952. H. D. Kessler. 38p. (WAL-401/103-11; U-23305)

Ti-Al-Cr and Ti-Al-Mo alloys were studied in detail as examples of two types of Ti-Al ternary alloys which would be expected to respond to widely differing heat treating procedures. A section of this report covers the theoretical aspects for the selection of Cr and Mo additions to the Ti-Al base composition. The equilibrium $\beta \rightleftharpoons \alpha$ transformation temperature was determined for the 9 alloys of each system. Subsequent work consisted of studies directed toward a thorough understanding of the transformation kinetics involved. End quench hardenability and isothermal transformation diagrams were obtained for most of the alloys. Initial tensile property determinations were made on alloys water-quenched and air-cooled from the β field. (auth)

5074

Armour Research Foundation

DEVELOPMENT OF PHASE EQUILIBRIUM DIAGRAMS FOR THE TITANIUM-RICH PORTIONS OF THE TERNARY SYSTEMS Ti-Mn-Al, Ti-Cr-Mo, AND Ti-Mn-Mo. INTERIM TECHNICAL REPORT [FOR] FEBRUARY 1, 1952–MAY 31, 1952. W. Rostoker and D. J. McPherson. June 19, 1952. 28p. (WAL-401/107-9; Interim Technical Report 2)

Revised phase boundaries at 3 isothermal levels and new boundaries at 5 temperature levels are given for the system Ti-Cr-Mo. A parametric surface for the β phase in the Ti-Mn-Mo system has been constructed. One almost complete isothermal section for the Ti-Mn-Al system is presented. (auth)

5075

Watertown Arsenal Lab.

INTERSTITIAL HOLES IN THE TITANIUM HCP LATTICE. B. Bovarnick. Aug. 12, 1952. 23p. (WAL-401/122)

The interstitial spaces of the hexagonal close-packed (HCP) lattice are defined. The radii of the largest spheres that may be contained within these spaces are calculated for the ideal and titanium HCP lattices. The lattices are considered to be strained, and the allowed variations of the radii of the contained spheres are evaluated. The dimensions of the spaces are compared with accepted values of the atomic radii of the elements in order to determine which elements might form interstitial alloys. (auth)

5076

SEMI-CONDUCTORS COMPOSED OF BORON WITH CARBON AND ALUMINUM. J. Lagrenaudie. J. chim. phys. 50, 352-5(1953) May. (In French)

The borides $B_{12}Al$ and B_4C and the borocarbide of Al are semiconductors. The energy of activation of B_4C is 0.7 ev by thermal measurements; of $B_{12}Al$, 1.7 ev; and of the borocarbide, 2.4 ev. The last two values were obtained by photoelectric measurements. (tr-auth)

5077

CRYSTAL-STRAIN EFFECTS IN COLD-WORKED WROUGHT ALUMINIUM AND ITS ALLOYS. W. M. Williams and R. Eborall. J. Inst. Metals 81, 501-12(1953) July.

Straining and annealing treatments have been applied to super-purity and commercial-purity Al and to four Al alloys, to test their behavior against a set of empirical rules describing the effects of strain, annealing temperature, and initial grain size on the critical strains and final grain sizes. The final grain size of the recrystallized material was found, for a given composition, to depend strongly on the strain and in most cases comparatively little on the annealing temperature and initial grain size, although the latter had a definite effect, especially in super-purity Al. Owing to the strength of this effect in super-purity Al, the max. grain size which could be produced by annealing at a given temperature was generally increased by coarsening the initial grain size, although for other materials the reverse was normally true. (auth)

5078

THE INFLUENCE OF COMPOSITION ON THE INCIDENCE OF STRAIN MARKINGS IN ALUMINIUM ALLOYS. W. H. L. Hooper. J. Inst. Metals 81, 563-8(1953) July.

Using the surface-measuring technique previously described, the form and intensity of stretcher-strain markings in relation to composition and thermal treatment have been investigated. It has been established that, in commercial and high-purity Al-Mg, itself, rather than impurities of grain-refining additions, is responsible for stretcher-strain effects, which are absent with less than about 1% Mg, and severe only with more than about 2% of this element. Low-intensity markings are developed in Al-Cu-Mg alloys after quenching to retain the alloying constituents in solid solution. It is concluded that, as in mild steel, strain markings are associated with atomic rearrangement in an unstable, supersaturated solid solution. (auth)

5079

A THEORETICAL INVESTIGATION OF THE DEFORMATION TEXTURES OF TITANIUM. D. N. Williams and D. S. Eppelsheimer. J. Inst. Metals 81, 553-62(1953) July.

The deformation process in Ti was examined by applying the Calnan and Clews method of texture analysis to the experimentally determined textures. It proved possible to develop a theoretical deformation process which would result in the formation of the observed deformation textures. This deformation process required the interaction of three slip systems, $\{0001\}\langle 11\bar{2}0\rangle$, $\{10\bar{1}1\}\langle 11\bar{2}0\rangle$, and $\{10\bar{1}0\}\langle 11\bar{2}0\rangle$, and two types of twinning, $\{10\bar{1}2\}$ and $\{11\bar{2}2\}$. Each of these modes of deformation was examined separately, and then they were combined to give the observed deformation textures. The critical shear stresses for slip (C_s) and for twinning (C_t) were found to be related in the following manner: $C_{s1011} = 1.1\ C_{s10\bar{1}1} = 1.02\ C_{s10\bar{1}0} = C_{t1012} = C_{t11\bar{2}2}$. (auth)

5080
THE STRUCTURE OF TITANIUM-TIN ALLOYS IN THE RANGE 0-25 AT.-% TIN. H. W. Worner. J. Inst. Metals 81, 521-8(1953) July.

Ti-Sn alloys in the range 0 to 25 at.% Sn have been investigated by metallographic and Debye-Scherrer x-ray-diffraction methods, and a partial phase diagram has been established. Detailed results for two groups of alloys are given; one group was based on a commercial grade of Ti, the other on Ti refined by the iodide process. Sn depresses the freezing point of Ti, and there appears to be a eutectic point in the vicinity of 17 at.% Sn at 1550°C approximately, the solid constituents involved in the eutectic transformation being a solid solution of Sn in β Ti and a phase, designated γ, based on Ti_3Sn. The solid solubility of Sn in α Ti is just over 10 at.%, and it varies only slightly in the range 700 to 880°C. The solubility of Sn in β Ti increases from 7.5 at.% at 885°C to ~10 at.% at 1100°C. Addition of Sn to Ti depresses the $\alpha \rightleftharpoons \beta$ transformation region to a min. of 845°C at 5 at.% Sn; above 5 at.% the $(\alpha + \beta)$ range rises to meet a peritectoid horizontal at 885°C. The peritectoid composition is 10.5 at.% Sn, and the peritectoid reaction is: α(10.5 at.% Sn) $\rightleftharpoons \beta$(7.5 at.% Sn) + γ(22 at.% Sn). The γ phase has an ordered structure (DO_{19}-type) based on the hexagonal close-packed structure. Sn hardens α Ti considerably, but the hardness of the alloys cannot be appreciably varied by heat-treatment. (auth)

5081
THE APPLICATION OF GRAIN REFINEMENT TO CAST COPPER-ALUMINIUM ALLOYS CONTAINING THE BETA PHASE. J. P. Dennison and E. V. Tull. J. Inst. Metals 81, 513-20(1953) July.

A consideration of previous work pointed to the nucleation method as offering the greatest chance of success in refining the grain size of cast duplex $(\alpha + \beta)$ Cu-Al alloys. Accordingly, melts were treated with a range of additions likely to form nucleating compounds. The selection of possible compounds was based on their having a lattice structure and dimensions similar (within certain limits) to those of either the α or the β phase of the Cu-Al system. Good confirmation of the nucleation theory was obtained, particularly with additions of B, which is thought to produce nucleation when present as B_4C. It has been found that in the presence of B the mechanism of solidification of the 90:10 Cu-Al alloy involves the initial solidification of the β phase. Results obtained on the laboratory scale were entirely confirmed by tests on a commercial scale with 500-lb billets. With the latter, comparative mechanical tests showed that the tensile strength had increased by 13% and the elongation by 46%, when refinement was at a max. (auth)

PHYSICS

5082
Purdue Research Foundation
RESEARCH WITH HIGH ENERGY ELECTRONS AND X-RAYS PRODUCED BY A 300 MEV SYNCHROTRON: PROGRESS REPORT. June 30, 1953. 36p. (COO-175)

The modifications made on the synchrotron magnet, vacuum system, electron gun, and resonator to produce satisfactory beam intensities are discussed. The vacuum properties of several coating materials were determined. The cloud chamber and associated equipment are now ready for research. A counter telescope system with its associated electronic circuits has been built. The telescope utilizes two stilbene crystals in coincidence and a large liquid-scintillator cell in anticoincidence and will be used for detection of protons and mesons. (For preceding period see AECU-2036.) (L.M.T.)

5083
National Bureau of Standards
EDDY-CURRENT MUTUAL-INDUCTANCE TRANSDUCERS WITH HIGH-CONDUCTIVITY REFERENCE PLATES. Horace M. Joseph and Nathan Newman. June 15, 1953. 81p. (NBS-2558)

The design considerations of mutual-inductance devices for use in non-contacting measurements of distance are studied with special emphasis on the eddy-current type utilizing perfectly conducting reference plates. The force on the plate due to the exciting current, some typical schematic circuits used to detect the results, and the effects of rapid motion of the gage are given. Since actual reference plates are not perfectly conducting, some indications of the effects of finite conductivity and limited extent of reference plates are included. (auth)

5084
Chicago Univ.
NATURAL TRITIUM ASSAY, ROUTINE METHOD FOR ABSOLUTE ASSAY OF BETA RADIOACTIVITY, AND THE REACTIONS OF NEGATIVE π MESONS WITH ELEMENTARY BROMINE: FINAL REPORT. W. F. Libby. Dec. 1, 1952. 110p. (NP-4654)

Methods and principles used in making routine measurements of T in natural waters using the electrolytic concentration plant and T-counting technique are presented. Theoretical implications of the total production rate for natural T are discussed. Data and equations are presented which show that rain waters are more radioactive than surface waters, thus establishing that T is produced by cosmic radiation. Various theories on the distribution of T in rain, lakes, and oceans are discussed. Reference is made to meteorology and the dating of organic materials by T on a 12.5-yr half-life basis. Samples of old water are being measured to determine whether the T content correlates with the expected exponential decay rate. Vintage wines are being procured to substantiate this. A routine method of absolute β assay of pure β emitters with an error not exceeding 5 or 10% has been developed. The π^- meson activation of Br is discussed, and radioactivities produced were separated and measured and the absolute yields determined by the use of absolute β-assay techniques, together with an absolute measurement of the number of mesons entering the elementary Br target. In general, neutron emission is more probable than charged-particle emission. For Br the most probable process is emission of about 3 neutrons and 1 proton. This corresponds to a mountain peak on the yield map which shows that 8% of all π^- mesons absorbed will yield the 26-hr As^{76}. The slope of the yield peak is steep in all directions from the peak, the lowest slope corresponding to about 3 neutrons for every proton. For example, at 2 protons and 6 neutrons the yield has dropped to 1.5%. (J.A.G.)

5085
Laboratory for Insulation Research, Mass. Inst. of Tech.
TABLES OF DIELECTRIC MATERIALS. VOL. 4. Jan. 1953. 156p. (NP-4665; Technical Report 57)

5086
Carnegie Inst. of Tech.
A PRECISE DETERMINATION OF e/m FOR 375 MEV PROTONS. Donald J. Grove. May 1953. 175p. (NYO-3656)

The charge-to-mass ratio for 375-Mev protons having $\beta = 0.7$ has been measured using the internal beam of the Carnegie Inst. of Tech. 140-in. synchrocyclotron. A

0.00033-in. W wire perpendicular to the pole faces at 61-in. radius served to sample the proton beam by scattering a small percentage of the protons into a scintillation counter located above the midplane and at approximately the same radius. Examination of the signal from the counter yielded the location of the synchronous orbit. A frequency discriminator permitted determination of the angular frequency corresponding to protons in this orbit, and this together with measurement of the magnetic field yielded e/m, since $(e/m)_1 = \omega c/H$. A careful measurement of the location of the magnetic center fixed the radius of the synchronous orbit so that the above value of e/m could be compared with that obtained from the relativistic expression $(e/m)_2 = (e/m_0) \times (1 - \omega^2 r^2/c^2)^{1/2}$. From 60 measurements for $(e/m)_1 - (e/m)_2/(e/m)$ the value -0.00075 ± 0.0006 is obtained. It is concluded from this that the relativistic theory for the variation of mass with velocity is confirmed for heavy particles to an accuracy of 0.1%. A complete description of the apparatus and experimental procedure is given together with some discussion of particle oscillations in synchrocyclotrons. Also included are a discussion of the experimental results, a survey of contributing errors, and a justification of the method as a verification of relativistic theory. (auth)

AEROSOLS

5087

A RECORDER FOR RADIOACTIVE AEROSOLS. J. Labeyrie and M. Pellé. J. phys. radium 14, 477-80(1953) July-Aug.-Sept. (In French)

This apparatus gives a continuous measure of the α, β, and γ radioactivity carried by the aerosols present in the air. The aerosols are deposited by suction on a special, constantly unrolling, paper filter. The activity of the aerosols is measured by a proportional counter with walls of thin mica, placed above the point at which the aerosols are collected. The sensitivity of the apparatus is sufficient to detect traces of Pu or Ra less than the tolerance dose (5 α/min/m^3), or to measure traces spontaneously derived from Rn in the atmosphere. (tr-auth)

COSMIC RADIATION

5088

Institute of Industrial Research, Syracuse Univ.
STRUCTURE AND COMPOSITION OF AIR SHOWER CORES. Harold L. Kasnitz and Kurt Sitte. June 5, 1953. 48p. (NYO-3403)

Extensive air showers were observed with an arrangement in which details of their structure and composition could be studied with the help of a large cloud chamber and a 102-counter hodoscope, while extension trays permitted a classification of the showers in three groups according to their initial energy, and a selection favoring events with cores striking near the central cloud chamber-hodoscope set. The electron-density distribution is found to be flatter than the Molière structure function and, despite the different shower age in the three energy groups, nearly the same for all the showers recorded. A structure function $\phi(r) \propto r^{-0.76}$ to $r^{-0.85}$ in the immediate neighborhood of the core fits the data best. An attempt to correlate the very dense local cascades started by high-energy electrons or photons with the expected multiple cores representing the high multiplicity of the nuclear interaction initiating the shower failed; such local cascades as were observed appear to originate in events of remarkably constant energy (somewhat less than 10^{13} ev if they occur near the top of the atmosphere). The penetrating component contains N particles interacting in the Pb plates of the chamber with a mean free path of approximately 165 g/cm^2, and consisting of neutrons ($41 \pm 8\%$) and charged particles. The total abundance of penetrating particles near the core does not differ appreciably from that found by various authors in experiments not as strongly biased in favor of the detection of shower cores. The abundance ratio of N particles to μ mesons, and of penetrating particles to electrons, show only slight variations with the shower age and demonstrate that the nucleonic cascade reaches its maximum somewhat later than the electron cascade. (auth)

5089

Institute of Industrial Research, Syracuse Univ.
DEVELOPMENT OF AIR SHOWERS IN THE ATMOSPHERE. Kurt Sitte and Don L. Stierwalt, [Institute of Industrial Research,] Syracuse Univ. and Irving L. Kofsky, Smith Coll. June 5, 1953. 29p. (NYO-3404)

An experiment was carried out at Mt. Evans, Colorado, (altitude 4300 m) to study the development of extensive air showers in the atmosphere. Showers with cores striking near a cloud chamber-hodoscope arrangement were selected, and the differential energy spectrum of the shower particles was determined by observing their transition effect in six $\frac{1}{2}$-in. Pb plates with a 68-counter hodoscope. Each shower can be assigned an age classification on the basis of this energy spectrum. The lateral structure function between 2 and 8 m from the core was obtained from measurements of the particle densities at four extension trays containing 50 counters with a total area of 1.34 m^2. It was found from the hodoscope data that the lateral structure function of the showers of various ages does not agree well with the predictions of the single-particle cascade theory. The observed structure function for showers at and beyond the cascade maximum is less steep than expected near the axis; this is consistent with multiple production of shower-producing particles in the primary collision. It was also found that the lateral distribution of showers past the cascade maximum varies only slowly with age; this tendency is predicted in a general way by the cascade theory but only at a much later stage of development than observed and with quite a different slope of the distribution curve. The interpretation of this effect as the result of a "rejuvenation" of the shower by the continuous transfer of energy from the nucleonic cascade to the electron cascade is therefore more likely. (auth)

5090

SPATIAL DISTRIBUTION OF THE PENETRATING PARTICLES IN ATMOSPHERIC SHOWERS OF COSMIC RAYS. L. Kh. Eĭdus, M. L. Adamovich, I. A. Ivanovskaya, V. S. Nikolaev, and M. S. Tulyankina. Translated from Zhur. Eksptl' i Teoret. Fiz. 22, 440-7(1952) 8p. (AEC-tr-1589; AERE Trans. 11/3/5/295).

An abstract of this article appears in Nuclear Science Abstracts as NSA 7-1155.

5091

ON THE LONGITUDINAL DEVELOPMENT OF AIR SHOWERS ACCORDING TO FERMI'S THEORY OF MESON PRODUCTION. E. Amaldi, L. Mezzetti, and G. Stoppini. Nuovo cimento (9) 10, 803-16(1953) June 1. (In English)

The longitudinal development of an air shower produced by a primary proton of 10^{14} ev has been calculated numerically, with the method of successive collisions, under the assumption that in the collision between two particles the production of pions and nucleons follows the thermodynamic approximation of Fermi's theory. In the high-energy region ($W \geq 5000$ bev) there is production of $\pi^{\pm}$ and π^0 mesons as well as pairs of nucleons, while in the low-energy region only $\pi^{\pm}$ and π^0 are produced. In the low energy region the calculations have been made under two different assumptions: in one case the collision is totally anelastic, while in the other case, the energy available in the center of the

gravity frame of reference is divided equally among the produced mesons and the nucleons taking part in the collision. The development of the various components throughout the atmosphere is given graphically. While the ratio of the penetrating component to the electronic component turns out to be of the right order of magnitude in both cases (1% in the first case and 3% in the second case) the penetrating component is too rich in nucleons, especially in the second case. (auth)

5092

LONGITUDINAL DEVELOPMENT OF EXTENSIVE AIR SHOWERS. H. Messel and R. B. Potts. Nuovo cimento (9) 10, 754-78(1953) June 1. (In English)

A theory of cosmic-ray showers is presented which embraces the following features: it is assumed that the primary radiation consists of nucleons; the nucleons generate the pion component by collision with nuclei; the charged pions decay into muons; the neutral pions decay into photons which initiate the soft component. Detailed numerical results are given for the average numbers (or intensities) of the various components at different depths in the atmosphere and for different energy ranges (only particles with energies > 10 bev are considered). The theory predicts that the charged pion and soft components have maxima at about 125 g/cm^2 and that the number of high-energy muons increases with depth, showing no maximum. The radiation is predominantly muons up to about 8000 m and the number of high-energy charged pions at sea level is much greater than the number of high-energy nucleons. This latter feature provides a test of the assumption that the high-energy pions do not interact with nuclei in the atmosphere. It is concluded that high-energy charged pions must interact with nuclei and that their interaction mean free path is longer than that for nucleons. The total meson component and the total radiation follow very closely a power law with the same exponent as that assumed for the primary nucleons. (auth)

5093

ZENITHAL DISTRIBUTION OF PARTICLES IN EXTENSIVE AIR SHOWERS. M. Cresti, A. Loria, and G. Zago. Nuovo cimento (9) 10, 779-83(1953) June 1. (In Italian)

Zenithal distributions for two average densities of particles of extensive air showers have been deduced directly from angular measurements in a cloud chamber. These results are in good agreement with those obtained by other workers using counters. Upper limits for the attenuation-length values have also been derived. (auth)

5094

A CLOUD CHAMBER STUDY OF THE BACKGROUND RADIATION SHOWER UNDER LEAD BETWEEN TWO MAXIMA OF THE EXTINCTION CURVE. Georg Pfotzer. Z. Naturforsch. a8, 353-60(1953) June. (In German)

The nature of the radiation showers under Pb was investigated between 2 maxima of the Rossi curve by the cloud-chamber method. In addition to the normal electron or μ-meson showers accompanying the impact electrons, small showers of a different kind were detected in abundance. The explanation of these showers is that either the specific maximum showers are electronic or they are modified so that the simultaneous ionization effects are detectable through extinction of the impact ionization in the counter tube. The second maximum can become lost because the maximum showers are electronic only in the coinciding stage. The total abundance of showers is explained by the impact process of μ mesons. A consistent hypothesis of the absorption coefficient of γ radiation is produced by a genetic relationship to the weak component. (tr-auth)

5095

A NEW NEUTRAL PARTICLE IN COSMIC RADIATION. W. Bothe. Z. Naturforsch. a8, 393-4(1953) June. (In German)

The second to the fourth maxima in the Rossi curve suggest the possibility of a new particle in cosmic radiation. An analysis of the ionization cross section, energy, and ionization depth permits a characterization of this particle. It would be an electrically and magnetically neutral particle, and its detection in a cloud chamber would be quite difficult. (J.S.R.)

5096

INVESTIGATION OF THE BIOLOGICAL EFFECT OF COSMIC RADIATION. Jakob Eugster. Naturw. Rundschau 6, 281-3(1953) July. (In German)

The quality and intensity of cosmic radiation and its biological effects were investigated at various altitudes. The results indicated that the radiation has predominantly a stimulating, rather than a harmful, effect on the life processes. Harmful effects occur chiefly at high altitudes and are caused by the heavy particles of cosmic radiation. (J.S.R.)

5097

CORRELATION OF A PAIR OF NEIGHBORING STARS. G. Lovera, L. Barbanti Silva, C. Bonacini, C. De Pietri, R. Perilli Fedeli, and A. Roveri. Nuovo cimento (9) 10, 986-7(1953) July 1. (In Italian)

An Ilford G5 emulsion exposed for approximately 8 hr had a pair of stars separated by 2 μ. The energy of the major star, if one assumes a relativistic track and a proton origin, is of the order of 2 bev. The minor star consists of 4 prongs. The energies of the prongs are calculated. (J.S.R.)

5098

CONTRIBUTIONS TO THE τ-MESON INVESTIGATION. E. Amaldi, G. Baroni, C. Castagnoli, G. Cortini, and A. Manfredini. Nuovo cimento (9) 10, 937-48(1953) July 1. (In English)

Two τ mesons have been observed in photographic emulsions exposed to cosmic rays at an altitude of 26,000 m. The corresponding data are summarized. The process of decay of τ mesons is considered and, by means of a statistical consideration applied to the measurements on τ mesons observed by various authors, it is proved that the process of decay into 3 π is by far the more likely. The spectrum of the decay products of τ mesons is considered. A comparison with the spectrum calculated on the basis of the statistical factors does not allow any definite conclusion to be reached about the possible existence of correlations among the three decay products on account of the very poor statistics available. Finally, the ratio τ mesons/π mesons coming to rest in the emulsions is considered. A comparison is made between the values of this ratio at balloon and at mountain altitudes. (auth)

5099

ON THE ASSOCIATED PENETRATING PARTICLES UNDERGROUND. C. Castagnoli, A. Gigli, and S. Sciuti. Nuovo cimento (9) 10, 893-7(1953) July 1. (In English)

The cross section for production of "associated penetrating particles," capable of penetrating at least 15 cm of Pb, by cosmic radiation at a depth underground equivalent to 50 m of water has been studied with a counter hodoscope. The results confirm those previously obtained and published by us, and they are briefly discussed and compared with recent ones obtained by other authors. (auth)

5100

THE RELATIONSHIP BETWEEN THE NUMBER OF NEUTRONS AND PROTONS AND SOME PROPERTIES OF THE NUCLEONIC COMPONENT AT 3500 m ABOVE SEA LEVEL. M. Conversi, G. Martelli, and P. Rothwell. Nuovo cimento (9) 10, 898-914(1953) July 1. (In Italian)

A fast, thin-walled ionization chamber, surrounded with G-M counters connected to a 22-channel hodoscope, has been used to investigate some properties of the nucleonic component present at 3500 m above sea level. The picture of each nuclear interaction taking place in the chamber in which prongs are emitted which cross the counters, is recorded by a typewriter triggered by the hodoscope. These "detectable prongs" are shown to correspond to the "grey tracks" and "shower particles" observed in photographic emulsions. Some results of the analysis of more than 13,000 stars are reported. The ratio, ρ, of stars produced by neutrons to stars produced by protons is determined for stars with different numbers of detectable prongs. In particular it is found $\rho = 23 \pm 0.4$ for stars with "no prongs" (which are shown to be produced by nucleons of average energy E = 35 Mev) while $\rho = 1.53 \pm 0.04$ for stars with at least one prong (E > ~400 Mev). It is shown that the high value of ρ for stars of $\bar{E}$ = 35 Mev cannot be interpreted only in terms of charge exchange and ionization losses undergone by protons through the atmosphere, but it is explained if the Coulomb barrier of the interacting nuclei is also considered. The probabilities of producing a star with a given number of "backward" prongs are deduced for both neutrons and proton primaries. Approximately 30% of stars with at least one "detectable prong" have at least one backward prong. The zenith angle distribution of protons of E = 35 Mev is found to fit a $\cos^{2.8}$ law. The differential distribution of stars with respect to the number of detectable prongs is given for both proton- and neutron-formed stars. Good agreement is shown to exist between our results and the phenomenological theories of the nucleonic component. (auth)

5101

THE SPECTRA AND SIGN DISTRIBUTIONS OF PARTICLES FROM COSMIC RAY STARS AT 2860 METRES ALTITUDE. C. C. Dilworth and S. J. Goldsack. Nuovo cimento (9) 10, 926-36(1953) July 1. (In English)

Measurements on mesons and protons emitted from stars recorded at 2800 m have been made and compared with published results for balloon altitudes. It appears that, while the multiplicity of showers is greatly reduced at the lower altitudes, the normalized energy spectra are closely similar. The determination of the sign of the charge of particles leads to a preliminary determination of the positive-negative ratio of mesons produced at this altitude and of unidentified particles primary and secondary to stars. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5102

Atomic Energy Project, Univ. of Rochester

COLLAGEN-CRYSTAL RELATIONSHIPS IN BONE. 2. ELECTRON MICROSCOPE STUDY OF BASIC CALCIUM PHOSPHATE CRYSTALS. M. L. Watson and R. A. Robinson. May 18, 1953. 42p. (UR-232)

Evidence is presented which indicates a similarity in structure of biological and synthetic basic Ca phosphate crystals. The growth and preferred orientation of synthetic crystals, as observed under the electron microscope, is described, and comparison is made with bone crystals and with enamel crystals from human and rat teeth. 28 references. (C.H.)

5103

THE PLASTICITY AND FRACTURE OF IRRADIATED AgCl SINGLE CRYSTALS. Yin-Yuan Li. Acta Met. 1, 455-6 (1953) July.

Changes are described which were produced in the plastic and fracture properties of AgCl single crystals by irradiation with x rays or with ultraviolet light. (C.H.)

ELECTRICAL DISCHARGE

5104

MAGNETO-HYDRODYNAMIC IMPACT WAVES IN A PLASMA OF INFINITE CONDUCTIVITY. R. Lüst. Z. Naturforsch. a8, 277-84(1953) May. (In German).

The equation for the magneto-hydrodynamic planar impact wave in a plasma of infinite conductivity is shown to be analogous to the normal planar hydrodynamic impact wave. The analogy between the known and the newly derived conservation principles of magneto-hydrodynamics is discussed. The magneto-hydrodynamic impact waves which are parallel, perpendicular, and oblique to the nearer magnetic field are investigated. The transition boundary in the infinitely weak impulses is considered. (tr-auth)

ELECTRONS

5105

ELECTRON-ELECTRON SCATTERING IN THE ENERGY RANGE FROM 200 TO 300 Kev. K. Ulmer. Z. Physik 135, 232-47(1953). (In German)

The angular distribution of the scattering of electrons by free electrons was investigated for the primary energies 207 and 296 kev by the coincidence method. As the dispersed gas was H, the electron envelope could be considered as free with this primary energy. The measurements confirmed the Møller theory but not the theory of Mott and Rutherford. (tr-auth)

5106

QUANTUM MECHANICS OF STABLE ELECTRONS AND THE LAMB SHIFT. Ludwig Waldmann. Z. Naturforsch. a8, 329-30(1953) May. (In German)

By use of a non-relativistic approach, the Schroedinger equation has been solved for the energy change in a Lamb shift. The solution is in good agreement with a solution obtained using quantum electrodynamics. (J.S.R.)

5107

THE CONTRIBUTION OF ELECTRONS STRUCK BY μ-MESONS TO THE ULTRARADIATION SHOWER BEHIND VARIOUS LEAD THICKNESSES. G. Pfotzer. Z. Naturforsch. a8, 335-6(1953) May. (In German).

A linear relationship exists between the number of radiation showers behind a Pb block and the electron energy. The ratio of increase of showers to thickness of Pb remains constant after an initial sharp rise. At a constant meson intensity, the number of electron showers increases with the Pb depth until a peak is reached, and a gradual decrease begins. (J.S.R.)

5108

A CONTRIBUTION TO THE MEASUREMENT OF SECONDARY ELECTRON EMISSION. H. Gobrecht and F. Speer. Z. Physik 135, 331-48(1953). (In German)

An analysis of the possibility of error in the measurement of secondary electron yield shows that a part of the error, made because of the hypothetical geometry of the electron radiation system, can be eliminated by appropriate potential ratios. The significance of H_2O layers absorbing secondary radiation is discussed. In a detailed representation new kinds of antipotential curves are explained completely by the determination of reflected secondary particles. An approximation method is given for the determination of the constituents of the reflected electrons in the entire electron yield without regard for the emergence direction and the spatial distribution. It is an hypothesis that the spherical collecting electrodes and the secondary radiator consist of the same material. For Cr-Ni the primary potential of 1000 v gives a secondary reflected part of 22%. (tr-auth)

GASES

5109

Geological Survey

A NOTE ON THE TRANSIENT GAS FLOW PROBLEM. A. Y. Sakakura. June 1953. 12p. (TEI-329)

Expressions have been obtained for pressure distribution, velocity, volume flux, and total cumulative production of a gas well as a function of time after opening of a closed-down well. Static conditions prevail initially, and, after opening, the well produces at constant well-bottom pressure. The effect of the nonlinearity in Muskat's isothermal gas-flow equation is shown to be negligible. The calculations can be applied to problems involving short-term transient flow of gases, such as in experiments with radioactive tracers. (auth)

INSTRUMENTS

5110

Brookhaven National Lab.

NON-OVERLOAD AMPLIFIERS. W. A. Higinbotham. Apr. 1, 1953. 11p. (BNL-234)

A flexible-pulse amplifier with good overload properties was described in Rev. Sci. Instr. 23, 34(1952). In the present report, certain features of this amplifier are treated in more detail, its performance is evaluated, and some variants and improvements which have been made since that article was published are described. (auth)

5111

Radiation Lab., Univ. of Calif., Berkeley

MULTI-CHANNEL PULSE HEIGHT ANALYSER. Harry R. Bowman and Robert E. Thomas. Apr. 3, 1953. 5p. (UCRL-2164)

The problem of nuclear pulse-height analysis using 1024 sealers as components in a multi-channel analyzer is discussed. An anti-coincidence circuit and a coincidence circuit are used to produce the sorting action of pulses of variable heights into channels that correspond to finite ranges of pulse heights and to scale down and record pulses on mechanical registers. Since the 1024 scalers have a gating tube in their input circuits, the addition of a simple crystal anti-coincidence circuit is necessary to convert the units into analyzer components. A brief description of the system used is given, including an explanation of discriminator connection and operation, method of measuring the pulse, use of a pulse generator to facilitate the setting of the discriminator levels, and setting of channel widths. Analysis of the γ spectra of Na^{22} and Cs^{137} at 120,000 cpm indicated an energy resolution of the whole system of 8.5%. The over-all double-pulse resolving time of the system is 2 μsec. (J.A.G.)

5112

Radiation Lab., Univ. of Calif., Berkeley

20 KILOVOLT DELTA FUNCTION GENERATOR. Harry G. Heard. May 14, 1953. 18p. (UCRL-2207)

An electronically triggered pulse generator is described which furnishes 20-kv pulses having rise times of 0.6 mμsec. H thyratrons are used in a specially designed coaxial impulse generator which has a triggering time of the order of 100 mμsec. The time jitter of the entire system depends on the speed of the incoming trigger signal and the statistical formation time of an atmospheric gap and is of the order of a few mμsec. Triangular pulses having a width of 2.5 mμsec and an amplitude greater than 20 kv can be obtained. (auth)

5113

THIN WINDOW METAL IRRADIATION CELLS FOR HIGH-VACUUM OR HIGH-PRESSURE EXPERIMENTS. F. J. Shon, M. Steidlitz, and M. H. Feldman. Rev. Sci. Instr. 24, 550-1(1953) July.

During the course of certain radiation chemistry experiments, it became necessary to fabricate all metal irradiation cells (Faraday cages) which would have thin windows (0.001 to 0.005 in.) so that 1-Mev electrons could enter, and which would be suitable for high-pressure and/or high-vacuum applications without the use of "O" rings or similar packing materials. Several methods which have been successfully used to secure a thin-metal window to the body of the capsule are described. (auth)

ISOTOPES

5114

Brookhaven National Lab.

FRACTIONATION OF THE CARBON ISOTOPES IN DECARBOXYLATION REACTIONS. 6. COMPARISON OF THE INTERMOLECULAR ISOTOPE EFFECTS OF A PAIR OF ISOTOPIC ISOMERS. Jacob Bigeleisen and Max Wolfsberg. [1953] 7p. (BNL-1487)

Theoretical considerations show that malonic acid-$2C^{14}$ should decarboxylate precisely twice as fast as the isotopic isomer malonic acid-$1C^{14}$ liberates $C^{14}O_2$. The calculations are supported by the experimental data of Ropp and Raaen. It is shown that these experiments are consistent with a C^{14} isotope effect twice that of the C^{13} one. (auth)

5115

Committee on Nuclear Science, National Research Council

STATUS REPORT ON STANDARIZATION OF RADIONUCLIDES IN THE UNITED STATES. George G. Manov. July 1953. 22p. (NP-4664; Preliminary Report 13)

This report was prepared under the sponsorship of the Subcommittee on Beta and Gamma Ray Measurements and Standards. Information is presented on techniques of the standardization of radionuclides, the availability of certain standards, and their accuracy. The available standards include C^{14}, Co^{60}, I^{131}, P^{32}, Ra^{226}, and Ra D to E. The desirable standards for which some nuclear information is available but additional information is needed are Au^{198}, Fe^{55}, Fe^{59}, Na^{24}, and H^3. Desirable standards for which little nuclear information is available are Cr^{51}, Sr^{90}, Tl^{204}, and Zn^{65}. The information is believed to be current as of April 1, 1953. 124 references. (L.M.T.)

MASS SPECTROGRAPHY

5116

Atomic Energy Research Establishment, Harwell, Berks (England)

A SIMPLE MASS SPECTROMETER FOR ANALYSIS OF STABLE TRACERS. E. H. Cooke-Yarborough and M. C. B. Russell. Apr. 16, 1953. 20p. (AERE-EL/R-1171)

Some features are described of a 180° mass spectrometer designed for isotope abundance measurement. The ion current is amplified by an a-c amplifier, and the method of measurement, noise origins, and circuits for stabilizing the ion beam are discussed. The accuracy and range are sufficient for the majority of stable isotopic tracer experiments with C, N_2, and O_2. (auth)

5117

THE LIBERATION OF POSITIVE IONS BY NEGATIVE ION BOMBARDMENT OF SURFACES. R. H. Sloane and R. M. Hobson. Proc. Phys. Soc. (London) A66, 663-4(1953) July.

Sloane and Press (Proc. Roy. Soc. A168, 284(1938)), by means of a double mass spectrometer, analyzed the negative ions resulting from bombardment of surfaces with a positive ion beam. This note reports the inverse process, the liberation of positive ions from surfaces under negative ion bombardment, which was examined using essentially the same type of instrument. (L.M.T.)

5118

METHOD OF MASS-SPECTROGRAPHIC DISPERSION DE-

TERMINATION. Joseph Mattauch and Ludwig Waldmann. Z. Naturforsch. a8, 293-305(1953) May. (In German)

Even in the most carefully built mass spectrograph, one cannot rely on the ideal mass scale when measuring isotopic weights with highest precision, as is necessary for the calculation of nuclear binding energies. Instead, the actual mass scale in the neighborhood of a "line" of unknown mass has to be ascertained with the help of neighboring lines of known masses simultaneously recorded and measured (dispersion lines). The approximation of the mass scale and the evaluation of the unknown line can be done in a clear and general way by the use of Lagrange's method of interpolation. However, Lagrange's approximation without any further assumption would not be sufficient if one has at one's disposal only a few dispersion lines widely separated, as is the case especially in the range of light masses. Here one has to make partial use of the knowledge of the ideal mass scale; this is outlined in detail for the special cases of one and of two dispersion lines. In certain cases one will have to use up to three dispersion lines. Furthermore, it is not sufficient to ascertain the mass scale with the help of a set of dispersion lines in a certain range of the plate at a particular value of the field strength of the deflecting magnet (or of a similar parameter) in order to evaluate an unknown line which subsequently has been brought into this range by varying the field strength, because the dispersion of an apparatus depends always slightly on the field strength (i.e., on account of the unavoidable saturation phenomena of the Fe). The order of magnitude of this effect has been estimated from experiments. Finally, there is given an account of the ideal mass scales of all existing mass spectrographs, including recent precision mass spectrometers and a discussion of the methods of evaluation used up to the present time. (auth.)

5119

A NEEDLE VALVE TYPE OF VARIABLE GAS LEAK FOR MASS SPECTROMETERS. E. F. Babelay and L. A. Smith. Rev. Sci. Instr. 24, 508-10(1953) July.

A high-vacuum needle valve may be used as an adjustable leak for regulating the flow rate of gas samples to a mass spectrometer, when the valve is equipped with a wedge and lever system providing very sensitive control of the needle position. Flow through the leak is molecular at spectrometer pressures, but mass flow may be secured by inserting a capillary tube between the sample and the leak. The leak may be closed completely, thereby simplifying the design of the sample inlet system. (auth)

5120

SURFACE IONIZATION SOURCE USING MULTIPLE FILAMENTS. Mark G. Inghram and William C. Chupka. Rev. Sci. Instr. 24, 518-20(1953) July.

A new multiple-filament surface-ionization source has been developed for mass spectrometry which for several of the elements is many times more efficient than the usual single-filament surface-ionization source. Emission from the source can be shifted from the oxide to the metal position or vice versa by appropriate adjustment of temperatures. Because of the high efficiency of the source it is possible to look at the sample during a number of successive evaporations. Use of this source should eliminate the necessity of using electron-multiplier ion detection for some elements. (auth)

MATHEMATICS

5121

Section Technique de l'Armee. Groupement Atomique (France)

THE QUANTIZING OF THE KLEIN-GORDON FIELD. PART 1. (LA QUANTIFICATION DU CHAMP DE KLEIN-GORDON. PREMIERE PARTIE.) Claude A. Klein. 1952-53. 41p. (NP-4669)

The Klein-Gordon scalar field is defined by the function $\psi(\vec{x},t)$, whose space and time coordinates are invariant in a Lorentz transformation. This paper deals with the implications of the equation $(\Box - m^2)\psi = r$ as applied to the interaction representations of Schroedinger, Heisenberg, and Schwinger. The rules of canonical and invariant commutation are given for ψ and its conjugate π. The ψ and π fields are treated by lagrange and hamiltonian formalism. Several physical interpretations are given to the derived forms, and it is shown that the quantized equations describe particles with Bose-Einstein statistics and a neutral scalar meson field. Further theoretical development is applied to meson emission and absorption probabilities. (K.S.)

5122

Rochester Univ.

RELATIVISTIC TWO-BODY EQUATION AND THE NEW TAMM-DANCOFF METHOD. Abraham Klein. July 9, 1953. 6p. (NYO-3828)

The Tamm-Dancoff treatment of the two-nucleon equation is analyzed to show that, by an approximate choice of relative time dependence, the covariant equation can be reduced to the same form previously identified with the procedure of treating particles and antiparticles, emission and adsorption, in a symmetrical way. (K.S.)

MEASURING INSTRUMENTS AND TECHNIQUES

5123

Atomic Energy Research Establishment, Harwell, Berks (England)

THE USE OF THE PROBE UNIT TYPE 1014a WITH HALOGEN-QUENCHED GEIGER-MÜLLER COUNTERS. C. D. Florida and C. N. Davey. June 8, 1953. 9p. (AERE-EL/M-79)

Measurements of charge liberated per pulse and of plateau length and shape have been made on a number of halogen-quenched counters when used with a probe unit type 1014a. The results of these measurements show that, in general, the use of this probe unit is to be recommended with this type of counter. (auth)

5124

Atomic Energy Research Establishment, Harwell, Berks (England)

THE SYSTEM OF STEREOSCOPIC PHOTOGRAPHY AND REPROJECTION USED WITH THE HARWELL 18 INCH DIFFUSION CLOUD CHAMBER. H. C. Whitby. Mar. 1953. 17p. (AERE-GP/R-1129)

A stereoscopic wide-angle camera with associated film-winding mechanism and a reprojection apparatus with a screen in the form of a table rapidly adjustable in 3 planes are described with accompanying sketches and photographs. (auth)

5125

Joint Establishment for Nuclear Energy Research (Norway)

CALCULATION OF RANGE/ENERGY RELATIONS ESPECIALLY IN PHOTOGRAPHIC EMULSIONS. M. Bogaardt. 1953. 68p. (JENER-Pub.-6)

A brief review of nuclear emulsion development is followed by theoretical and experimental range-energy relationships for nuclear particles. Theoretical range-energy curves for protons, deuterons, tritons, and α particles in photographic emulsions are derived. Range-energy relations are determined for α particles of 2 to 10 Mev in light elements, heavy elements, and photographic emulsions. (K.S.)

5126

National Bureau of Standards

ALPHA-RAY MEASUREMENTS PROGRAM. G. M. Tem-

mer and J. M. Wyckoff. June 30, 1953. 27p. (NBS-2598)

The Alpha-Ray Measurements program of the NBS is providing a needed service of calibration and standardization of sources of α radiation. It is at present supplying standards of α radioactivity of U oxide electroplated on metal backing at the rate of approximately two per week. This program is being extended to include a supply of RaD+E+F standards as well. Detection techniques for α and γ radiation for specialized applications encountered in the heavy α-emitting elements are being perfected and used for the study of the nuclear properties of these elements. (auth)

5127

Naval Research Lab.

POTENTIAL INSIDE A GEIGER TUBE: INTERIM REPORT. Herbert B. Rosenstock and Norman M. Gailar. June 26, 1953. 6p. (NRL-4189)

The potential in a Geiger tube, here treated as a region bounded by two concentric cylinders of radius a and b, and two planes perpendicular to the axis of the cylinders and a distance L apart, with a constant applied potential on the inner cylinder, is obtained in the form of an infinite series, and numerical results are obtained from this for six sets of the parameters a, b, L. Applications to the design of proportional counters are discussed briefly. (auth)

5128

Radiation Lab., Univ. of Calif., Berkeley

INEXPENSIVE GAMMA DETECTOR. Donald R. Cone and David W. Garbellano. May 18, 1953. 16p. (UCRL-2226)

A simple and inexpensive radiation detection device has been constructed sensitive to γ fluxes in the range from a few to a few hundred r/hr. Thus the difference between dangerous and relatively safe radiation levels such as might be expected from radiological warfare, low-level atomic blasts, or from rigged H-bomb explosions can be distinguished. The device consists of two Cd tungstate crystals in a light-tight container which can be held close to one eye to exclude external light. A Ra-activated phosphorescent material is included for light-intensity comparison purposes. The thicker crystal can be discerned in a γ radiation of a few r/hr, and its light output matches that of the fluorescent material at levels of 20 to 30 r/hr. The light from the thinner crystal matches that of the phosphorescent material at about 100 r/hr. (auth)

5129

THE GRAIN DENSITY AND THE PROCESS OF TRACK FORMATION IN NUCLEAR EMULSIONS. PART II. GRAIN DENSITY AND ENERGY LOSS. M. Della Corte, M. Ramat, and L. Ronchi, Jr. Nuovo cimento (9) 10, 958-70(1953) July 1. (In English)

The method described in paper I (NSA 7-3849) for the evaluation of π (the probability that a grain be impressioned) has been applied to ~50 tracks, observed in Ilford G5 Plates and belonging to identifiable particles of a given range. Experimental data have been plotted versus energy loss and compared with the expression given by P. Demers. It is recognized that some modification of the theory is required to account for the results. In fact, it is shown that the discrepancies can be made to disappear if the effect of the electron recombination inside the grain is suitably taken into account. (auth)

5130

LARGE THIN-WALL GEIGER COUNTER. Thomas T. Sugihara, Richard L. Wolfgang, and W. F. Libby. Rev. Sci. Instr. 24, 511-12(1953) July.

A new thin-wall geiger counter of large area, sensitive to soft β radiation, has been developed. The sensitive area can be as large as desired and the wall thin enough for C^{14} (2mg/cm^2). The cylindrical geometry renders the counter especially suitable for accurate assays of large solid samples of low specific activity and low energy. (auth)

5131

SPECIFIC α RADIOACTIVITY OF ILFORD PLATE FOR NUCLEAR RESEARCH. S. Deutsch and E. C. Dodd. Nuovo cimento (9) 10, 858-61(1953) July 1. (In French)

The specific α activity in nuclear plates limits the possibility of measuring very weak α activities. The possibility of reducing this background radiation by purifying the gelatin and the water has been investigated. Purification of the gelatin reduces the α background by a factor of 2. (J.S.R.)

5132

THE DESIGN OF AN AUTOMATIC RECORDING ELECTROSCOPE AND ITS USE TO DETERMINE HALF-LIVES IN RADIOACTIVE DECAY. Rosalie M. Bartholomew, F. Brown, W. D. Howell, W. R. J. Shorey, and L. Yaffe. Can. J. Phys. 31, 714-22(1953) July.

An automatic recording electroscope has been constructed and used to determine short half lives in radioactive decay. The operation of the instrument has been tested by comparing it with both a manually operated electroscope and a 4π-type proportional β counter. The instrument produces results which are at least as accurate as any with which they may be compared. The half lives of $Co^{60\,m}$ and Al^{28} have been measured as 10.47 ± 0.02 min and 2.27 ± 0.02 min, respectively. (auth)

5133

AN EXPERIMENTAL STUDY OF COUNTING LOSSES DUE TO DEAD-TIME EFFECTS. C. H. Westcott, J. S. Greenberg, and J. S. Kirkaldy. Can. J. Phys. 31, 859-97(1953) July.

When using counting methods for studying instantaneous reactions produced with pulsed accelerators such as synchrotrons or synchrocyclotrons, the systematic errors in counting due to dead-time effects may be considerable. Westcott (Proc. Roy. Soc. (London) A194, 508(1948)) published a discussion of the simpler cases of pulsed single-channel counting; the present paper describes experimental investigations designed to extend the knowledge of these corrections, especially to cases of coincidence counting. (auth)

5134

THE STOMACH COUNTER. J. T. Lloyd. Atomics 4, 165-6(1953) July.

A small counter (2 by $^1/_4$ in. maximum) has been developed which can be swallowed and can remain in the stomach for periods up to two hours without undue discomfort. A strong silk cord is tied around the counter and brought out through the stomach tubes for the purpose of withdrawing the counter. The counter was designed to detect the emissions from P^{32} carried in the stomach liquids. Details of construction and a diagrammatic illustration are given. (L.M.T.)

5135

RECENT NUCLEONIC INSTRUMENTS: A SURVEY. Denis Taylor and L. A. Kilbey. Atomics 4, 155-64(1953) July.

A survey is presented of nucleonic instruments and accessories now being used in Great Britain. Included are various types of Geiger tubes, scalers and auxiliary apparatus, proportional counters, power supplies, counting-rate meters, pulse-amplitude discriminators, quartz-fiber dosimeters, various β and γ monitoring instruments, and radiac instruments. (L.M.T.)

5136

GRAIN SIZE IN ILFORD G5 EMULSIONS. E. Pickup. Can. J. Phys. 31, 898-900(1953) July.

This note reports the results of electron-microscope measurements of grain sizes and grain-size distribution in

processed Ilford G5 emulsions, both before and after intense electron bombardment. It is concluded that to make full use of any future increase in grain sensitivity a smaller grain size will be necessary for electron sensitive emulsions. (L.M.T.)

5137

ANALYSIS OF RADIONUCLIDE MIXTURES: USING A GAMMA-BETA SCINTILLATION SPECTROMETER. R. E. Connally and M. B. Leboeuf. Anal. Chem. 25, 1095-1100 (1953) July.

Beta- and γ-scintillation detectors have been designed for use with an automatic recording, energy spectrometer. The application of this instrument to the analysis of mixtures of radionuclides which decay by γ emission has been investigated. Integration of the area under the photoelectric peak of a differential pulse-height scan obtained with the γ energy spectrometer permits quantitative determination of each γ emitter present. Using this instrument, the γ activities present in solutions containing 3 γ emitters have been identified, and the individual γ activities have been determined with an average precision of ±7% (95% confidence limits) for triplicate determinations over concentrations of 10 to 70% of total γ activity. Analyses of solutions containing mixed γ emitters were performed directly, without preliminary separations, in less than 40 min. This instrumental method for the analyses of radionuclide mixtures should be of particular value to radiochemical process control because of its speed and reliability; in addition, it is expected to find application in any studies where mixed γ emitters are used. (auth)

5138

THE MEASUREMENT OF RADIOACTIVE CARBON IN GAS COUNTERS. A. F. Henson. Brit. J. Appl. Phys. 4, 217-19 (1953) July.

An a-c coupled quench circuit is used to quench counters containing non-selfquenching CO_2-CS_2 mixtures for the measurement of radioactive C as CO_2. The counters operate reliably at quite high counting rates, and continuous discharges do not occur. Plateaus 200 v or more long with slopes of about 2 to 4% per 100 v are obtained. Accurate corrections for resolving time loss can be made for counting rates up to at least 15,000 cpm. (auth)

5139

DIFFUSION CHAMBER WITH CONTINUOUS SENSITIVITY. André Voisin. J. phys. radium 14, 459-62(1953) July–Aug.–Sept. (In French)

The construction and operation of a diffusion chamber which permits the continuous observation of the trajectories of ionizing particles are described. (tr-auth)

5140

CONTINUOUS NEUTRON DETECTOR FOR THE MEASUREMENT OF THE DENSITY IN A PILE. V. Raievski and M. Pellé. J. phys. radium 14, 463-4(1953) July–Aug.–Sept. (In French)

The measurement of the neutron density in extended media has been made convenient with the aid of a continuous detector. A band of Cu has been used as a detector. After irradiation, the strip unwinds under a Geiger counter, and the activity is transcribed upon the paper of a recorder. The distribution curves in the reflector of the Châtillon pile and in the core of the Saclay pile have been obtained in this manner. (tr-auth)

MESONS

5141

Brookhaven National Lab.

ARTIFICIAL V PARTICLES: V^0'S PRODUCED AT THE COSMOTRON. W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore. [1953] 4p. (BNL-1504)

Artificial V^0 particles have been produced by the neutron beam emerging from a C target bombarded by 2.25-bev protons. No $V^{\pm}$ particles have yet been observed. Cloud-chamber photographs give strong evidence to support the $p + \pi^-$ decay scheme. Values of Q, calculated on this basis, agree closely with the accepted value of such a decay process. (K.S.)

5142

Radiation Lab., Univ. of Calif., Berkeley

EMPLOYMENT OF THE SPIRAL ORBIT SPECTROMETER TO MEASURE PION PRODUCTION RATIOS BY PROTON BOMBARDMENT. Ryokichi Sagane. May 26, 1953. 26p. (UCRL-2161)

Plus-minus ratios for pion production by 340-Mev proton bombardment were measured at 13, 18, and 42 Mev with the use of the spiral orbit spectrometer. Mesons of known energy intervals emitted at 90° produced by the proton beam at the target on the axis were efficiently detected by the C2, 200μ plates located near the outer edge of the pole pieces. Out of the results obtained by scanning the plates, the π^+/π^- ratios at 3 energies from Be, C, Al, Cu, Ag, and Pb targets were obtained. A rough estimate of the Z dependence of π^+ production at 42 Mev was also made. Since the spiral orbit spectrometer was found to be quite useful for this kind of experiment, experimental details and some of the results of the tests are given. (auth)

5143

Radiation Lab., Univ. of Calif., Berkeley

MEASUREMENTS OF MESON MASSES AND RELATED QUANTITIES. F. M. Smith, W. Birnbaum, and Walter H. Barkas. June 1953. 4p. (UCRL-2245)

Results are presented for the following determinations: fundamental mass ratios (π^+/proton, π^-/proton, and π^+/μ^+); absolute decay momentum of μ^+ mesons; derived masses in units of m_e(π^+, π^-, and μ^+); and absolute mass measurements in units of m_e(π^+, μ^+, and $\pi^+ - \mu^+$). (L.M.T.)

5144

Radiation Lab., Univ. of Calif., Berkeley

SOLUTIONS OF THE MESON-NUCLEON EQUATION IN THE ADIABATIC LIMIT. R. Arnowitt and S. Deser. June 29, 1953. 4p. (UCRL-2256)

The stability and scattering of meson-nucleon systems are examined by reducing the relativistic meson-nucleon equation, $[(\gamma p + m)(k^2 + \mu^2) - I]\psi = 0$, to a three dimensional form. A total potential well is obtained which is repulsive for $j = 1/2, 5/2, \ldots$, and attractive for $j = 3/2, 7/2 \ldots$. Assuming the V_0^1 particle to be a virtual state of the (p, π^-) system at 40 Mev and $l = 5$, a lifetime of 2×10^{-10} sec is obtained. The total cross section of the (p, π^+) system at 37 Mev is calculated to be 19.3 mb. (K.S.)

5145

EMISSION OF GAMMA-RAYS DURING DISINTEGRATION OF μ-MESONS. G. V. Skornyakov. Translated from Doklady Akad. Nauk S.S.S.R. 89, 431-4(1953). 4p. (NSF-tr-32; D-89-431)

A brief abstract of this article appears in Nuclear Science Abstracts as NSA 7-3856. (K.S.)

5146

INTERACTION OF π-MESONS OF THE ORDER OF APPROXIMATELY A HUNDRED MEGAELECTRON-VOLTS WITH NUCLEONS AND NUCLEI. J. Heidmann. J. phys. radium 14, 481-91(1953) July–Aug.–Sept. (In French)

A resume is given of experimental results recently obtained on the interaction of rapid π mesons, created artificially by large accelerators, with nucleons and nuclei. The existing theoretical interpretations are presented with a review of the ideas necessary for their comprehension. (tr-auth)

5147
THE NUCLEAR INTERACTIONS OF FAST μ-MESONS. Martin Deutschmann. Z. Naturforsch. a8, 308-11(1953) May. (In German)

The interactions of fast μ mesons with matter was investigated with a cloud chamber. The cloud chamber, containing 9 Pb plates 5 cm apart and shielded from cosmic radiation, corresponded to 442 m of Pb. Strongly ionized particles (protons or α particles) were observed which produced μ mesons by nuclear impact. Penetrating secondary particles were not found, since at sea level the reaction cross section for their production is less than 3.3×10^{-30} cm^2/nucleon. (tr-auth)

5148
THE GRAIN DENSITY IN THE TRACKS OF 117- AND 222-MEV π^- MESONS IN EMULSIONS. A. H. Morrish. Phys. Rev. 91, 423-4(1953) July 15.

Ilford G5 photographic emulsions, 400 μ thick, were exposed in succession to the 117-Mev and the 222-Mev π^--meson beams from a synchrocyclotron. The directions of the two beams into the plates were mutually perpendicular in order to facilitate easy and rapid identification of their tracks. In addition, some π^+ mesons were stopped in the plates. The electron tracks produced in the ensuing π-μ-e decay were used to give a measure of the "plateau" grain density existing in the plates. The blob-counting convention was employed throughout the work. The grain density of the 117-Mev π^--meson track was 0.02% higher and that of the 222-Mev track was 6.43% lower than that found for the electron tracks. (auth)

NUCLEAR PHYSICS

5149
Indiana Univ.
INDIANA CONFERENCE ON NUCLEAR SPECTROSCOPY AND THE SHELL MODEL [HELD AT INDIANA UNIVERSITY ON MAY 14–16, 1953]; SUMMARY REPORT. 50p. (NP-4659)

The discussions at this nuclear physics conference were, for the most part, concerned with theoretical aspects, although in some cases specific experimental observations were cited as support of the theory. Various aspects of β decay such as Fermi selection rules, forbidden and allowed transitions, isotopic spin in the shell model, etc., are discussed. Various aspects of γ radiation summarized include lifetime-energy relations, E1 transitions, classification by multipolarity, mixed multipoles, and directional and polarization-directional correlations. Discussions of resonance scattering of protons and stripping reactions are briefly presented. The nuclear models receive considerable treatment as to their adequacy or inadequacy in describing various phenomena. (L.M.T.)

5150
CHARGE INDEPENDENCE AND NUCLEAR REACTIONS. S. Devons. Proc. Phys. Soc. (London) A66, 665-6(1953) July.

The rule of conservation of isotopic spin has usually been applied to systems involving charge-symmetrical nuclei, where T = 0 for the initial and therefore also for "allowed" final states. This note draws attention to the application of this rule to a type of reaction which has been extensively studied ((p,α) reactions), in which the initial nuclei are not charge-symmetrical, the final nuclei are, and the reaction proceeds through well-defined states of a compound nucleus. (L.M.T.)

5151
MANY PARTICLE SYSTEMS: DERIVATION OF A SHELL MODEL. H. R. Post. Proc. Phys. Soc. (London) A66, 649-51(1953) July.

A many-identical-particle problem, the case of N identical particles moving in three dimensions and interacting by ordinary harmonic-oscillator pair forces, is solved in an attempt to provide some general rules concerning saturation and shell structure. The solution agrees with the independent-particle model for an over-all harmonic oscillator well, both as regards angular momentum and number of particles in a given shell. (L.M.T.)

NUCLEAR PROPERTIES

5152
SECOND ORDER NUCLEAR QUADRUPOLE EFFECTS IN SINGLE CRYSTALS. PART I. THEORETICAL. G. M. Volkoff. Can. J. Phys. 31, 830-36(1953) July.

The dependence of electric quadrupole splitting of nuclear magnetic resonance absorption lines in single crystals on crystal orientation in an external magnetic field is investigated theoretically. Explicit formulas are given, applicable to nonaxially symmetric crystalline electric-field gradients ($\eta \neq 0$) and valid up to terms of the second order in the quadrupole coupling constant $C_z \equiv eQ\phi_{zz}/h$, for the dependence of the absorption frequencies on the angle of rotation of the crystal about any arbitrary axis perpendicular to the magnetic field. Some formulas including third-order effects in C_z are also given. It is shown that an experimental study of the dependence of this splitting on the angles of rotation about any two arbitrary mutually perpendicular axes is sufficient when second-order effects are measurable, to yield the values of $|C_z|$, η, and the orientation of the principal axes of the electric-field gradient tensor at the nuclear sites. In the case that the direction of one of the principal axes is known from crystal symmetry, a single rotation about this axis gives the complete information. A new method of determining nuclear spin I is proposed which depends on comparing first- and second-order shifts of the resonance frequencies of the strong inner-line components. The method will be of interest in those cases where the total number 2I of line components can not be unambiguously ascertained owing to the outer line components being excessively broadened and weakened by crystal imperfections. (auth)

5153
SECOND ORDER NUCLEAR QUADRUPOLE EFFECTS IN SINGLE CRYSTALS. PART II. EXPERIMENTAL RESULTS FOR SPODUMENE. H. E. Petch, N. G. Cranna, and G. M. Volkoff. Can. J. Phys. 31, 837-58(1953) July.

Experiments on the splitting of the Al^{27} resonance absorption line in a single crystal of $LiAl(SiO_3)_2$ (spodumene) are described and are used to illustrate the second-order theory of Part I (see preceding abstract). $|eQ\phi_{zz}/h|$ for Al^{27} nuclei in spodumene is found to be 2950 ± 20 kc/sec $\eta \equiv (\phi_{xx}-\phi_{yy})/\phi_{zz}$ at Al sites is found to be 0.94 ± 0.01. The x principal axis (corresponding to the smallest eigenvalue ϕ_{xx}) of ϕij at the Al sites is found to coincide with the b axis of the monoclinic spodumene crystal. The other two principal axes lie in the ac plane with the y axis (corresponding to the intermediate eigenvalue ϕ_{yy}) making an angle of $56 \pm 0.5°$ with the crystal c axis towards the a axis. The y principal axis at the Al sites and the z principal axis at the Li sites appear to point at the projection of the nearest O ion in each case. The new method of spin determination proposed in Part I is checked by confirming the known value $I = 5/2$ for Al^{27}. (auth)

5154
ANALYSIS OF NUCLEAR EXCITATION LEVELS BY MEANS OF SHELL MODELS. L. K. Peker, L. A. Sliv, and A. V. Zolotavin. Doklady Akad. Nauk S. S. S. R. 88, 781-4 (1953) Feb. 11. (In Russian)

The energy levels of the elements with atomic number 21 to 69 are discussed on the basis of the nuclear shell model. Three cases of excitation level were considered: when the principal state of the final odd-numbered nucleons display elementary levels in some shells, the excitation will be superimposed on the level; when the odd-numbered nucleons in the principal state are found in the final or penultimate level of a shell, there will be nucleon transition from one filled level to another; and a composite system is found when equal levels of excitation have "holes." Excitation levels of Cs^{131}, Xe^{131}, and Mo^{95} are diagramed to illustrate the 3 cases. (J.S.R.)

5155

EXTENSION OF THE STATISTICAL THEORY OF ATOMIC NUCLEI. P. Gombás. Ann. Physik 12, 155-9(1953) Apr. (In German) (cf. NSA 7-1496, 1774, and 1775).

As a continuation of previous publications, in which the nucleon density in the nucleus and the nuclear energy were determined by the Ritz method in the first approximation, higher approximations of the Ritz method were worked out, and the distinction between the density distributions of the neutrons and protons determined. The density distribution of the nucleons in the higher approximations can be determined to only a small degree, i.e., the density distribution remains, even in the higher approximations, essentially a Gaussian distribution. The distinction between the neutron distribution and the proton distribution is found to be small. The amount of nuclear energy per nucleon, or the binding energy of the nucleus per nucleon, shows in the higher approximations a small increase, which increases with the mass number, as predicted in the earlier publications. (tr-auth)

5156

NUCLEAR MAGNETIC RESONANCE MODULATION CORRECTION. E. R. Andrew. Phys. Rev. 91, 425(1953) July 15.

Perlman and Bloom (Phys. Rev. 88, 1290(1952)) showed that a correction must be applied to measured nuclear magnetic resonance second moments if accurate structural information is to be deduced. They found the true second moment S_2 to be related to the measured value S_2' by the relation $S_2' = S_2 + \frac{1}{3}h_m^2$, where h_m is the amplitude of the field modulation. Their approximation assumed that the modulation spreads the true absorption curve evenly over the range of modulation. A direct calculation, without this approximation, leads to the same form of correction as the above expression, but the coefficient of the last term is $\frac{1}{4}$ rather than $\frac{1}{3}$. (L.M.T.)

5157

INVESTIGATION OF THE EXCITATION STATE OF TITANIUM BY MEANS OF THE γ-γ ANGULAR CORRELATION. Peter Meyer and Siegfried Schlieder. Z. Physik 135, 119-24(1953). (In German)

By use of 2 scintillation counters and a coincidence circuit of high resolving power, the number of γ-γ coincidences was measured for a V^{48} compound by slopes of the angles which are formed by the emission directions of the γ quanta. By comparison with the analogous measurement of Na^{22}, the disturbing influence of the positron annihilation radiation was removed, and the angular correlation of the γ-γ cascade of Ti^{48} was obtained. This correlation shows that the first excitation state of Ti^{48} possesses spin 2 and the second excitation state spin 4. Both transitions proceed by quadrupole radiation. (tr-auth)

5158

AN ANALYSIS OF ANGULAR CORRELATION EXPERIMENTS WITH A REPORT OF SUCH A MEASUREMENT IN Ni^{60}. Santimay Chatterjee and Ajit Kumar Saha. Z. Physik 135, 139-51(1953) (In German)

A complete analysis of the hypothesis for the measurement of the angular correlation ratios of the annihilation radiation emitted by an activated nucleus has been completed. A general expression for the time in which the total number of coincidences for any period has been observed has been derived so that the error of correlation ratios remains within a determined limit. For the influence of the Compton scattering on the correlation ratio a theoretical formula is indicated. This formula agrees well with the experimental results. The influence of the angular scattering on the correlation ratio was obtained from finite measurements of the values. The measurements made on Ni^{60} are given. The results agree with those obtained by other researchers. Other methods are given for obtaining agreement with greater accuracy. (tr-auth)

5159

MEASUREMENT OF THE AVERAGE ENERGY OF THE α PARTICLES OF SAMARIUM WITH THE AID OF NUCLEAR EMULSIONS. D. Szteinsznaider. J. phys. radium 14, 465-72(1953) July-Aug.-Sept. (In French)

The energy of the α particles of Sm has been determined in experimental conditions, as well defined as possible, with nuclear emulsions. The energy is 2.12 ± 0.03 Mev. This result compares favorably with former results. (tr-auth)

NUCLEAR REACTORS

5160

Oak Ridge National Lab.

CURRENT STATUS OF THE THEORY OF REACTOR DYNAMICS. W. K. Ergen. July 20, 1953. 17p. (CF-53-7-137)

Brief discussions of the classical inhour equation, the transfer function, reactor simulators, and recent developments in the non-linear theory of self-stabilization of reactors are presented. (J.A.G.)

5161

TRANSIENT OPERATION IN A HEAVY WATER REACTOR. V. Raievski. J. phys. radium 14, 473-7(1953) July-Aug.-Sept. (In French)

The variation of the power and reactivity of a heavy-water reactor has been studied when the control rods are continuously raised. It is demonstrated that during subcritical operation (negative reactivity) the power is determined by the reactivity and by the intensity of the photoneutrons resulting from the previous load of the reactor. When, in the course of raising the rods, the reactor passes critical operation (zero reactivity), the power attained is independent of the initial reactivity. During supercrictical operation (positive reactivity) the temperature elevation of the U bars retards the power increase produced by the removal of the bars. The power approaches a value which depends only on the cooling of the reactor and on the available reactivity. (tr-auth)

NUCLEAR TRANSFORMATION

5162

Brookhaven National Lab.

YIELD OF Xe^{133} IN THE THERMAL NEUTRON FISSION OF U^{235}. Seymour Katcoff and William Rubinson. [1953] 49p. (BNL-1485)

The yield of 5.27-day Xe^{133} in the thermal neutron fission of U^{235} was determined accurately by a method in which the fission rate was measured with a double chamber fission counter and in which the disintegration rate of the chemically separated Xe was measured by gas-phase proportional counting. Five separate determinations gave a mean value of $6.62 \pm 0.15\%$, where the indicated error is the 99 to 1 probable error. A considerable number of possible

sources of error was investigated in detail and taken into account when making the measurements and calculations. As by-products of this work, it was determined that the independent yield of Xe^{133} in U^{235} fission is not greater than 0.1% of the chain yield, the independent yield of 9.15-hr Xe^{135} is ~3.5% of the total yield of the mass 135 chain, and the half life of I^{133}, as measured by a procedure which circumvented most of the interference from other nuclides, is 20.8 ± 0.2 hr. (auth)

5163
Johns Hopkins Univ.
NEUTRONS FROM $Be^9(d,n)B^{10}$; [FINAL REPORT]. C. D. Swartz and J. S. Pruitt. Feb. 1953. 28p. (NYO-671)

The energies and angular distributions of neutrons from $Be^9(d,n)B^{10}$, leaving B^{10} in its five lowest states, have been measured by photographic plate methods. The excitation energies of the B^{10} states are measured to be: $E_x = 0.00$ Mev (ground state), 0.74 ± 0.11, 1.77 ± 0.10, 2.20 ± 0.10, and 3.67 ± 0.09 Mev. The angular distributions are considered to be linear superpositions of terms due to stripping and terms due to ordinary compound nucleus formation. For the uppermost three states, the extra proton is captured in a p orbit. The spin of the second excited state is $J = O^+$. Limits are set for the spins of the other states. All conclusions are in good agreement with the work of others. (auth)

5164
Yale Univ.
ENERGY LEVELS IN A^{38} FROM THE Cl(α,p) REACTION. A. Z. Kranz and W. W. Watson. [June 11, 1953] 7p. (NYO-6218)

AgCl targets containing 94% Cl^{35}-6% Cl^{37} and 62% Cl^{37}-38% Cl^{35} were bombarded with α particles. The protons resulting were observed at 90 and 0° to the incident beam and established excited states in the A^{38} nucleus at 2.13 ± 0.04 and 3.73 ± 0.04 Mev. No groups from A^{40} were observed. (auth)

5165
Yale Univ.
PROTONS FROM THE DEUTERON BOMBARDMENT OF Kr^{84} AND Kr^{86}. G. W. Wheeler, R. B. Schwartz, and W. W. Watson. [1952] 10p. (NYO-6219)

Samples of Kr gas enriched to 70.5% in Kr^{84} and to 82.0% in Kr^{86} were prepared by a thermal diffusion method. These samples were bombarded with 3.80-Mev deuterons. Q values of 3.72 ± 0.05 Mev and 3.43 ± 0.05 Mev are observed for the ground state and first excited state of Kr^{85}. Q values of 3.30 ± 0.05 Mev and 2.78 ± 0.05 Mev are observed for the ground state and first excited state of Kr^{87}. The masses of Kr^{85} and Kr^{87} are 84.94090 ± 13 and 86.94125 ± 12. (auth)

5166
Radiation Lab., Univ. of Calif., Berkeley
YIELD OF CHARGED PIONS AT 180° TO THE BEAM BY 340 MEV PROTONS ON CARBON (thesis). Stanley Lee Leonard. May 1953. 56p. (UCRL-2210)

The yield of charged pions at 180 ± 5° to the beam by 340-Mev protons on C has been measured, using nuclear emulsion techniques. Nuclear emulsions embedded in Cu, Al, or lucite absorber blocks were exposed to magnetically separated positive and negative pions emitted at 180° by graphite targets bombarded in the electrically deflected proton beam of the Berkeley synchrocyclotron. Plates were exposed for a series of pion energies. The developed emulsions were examined with a microscope under high magnification and meson-track endings were identified and counted. The values of $d\sigma/d\Omega dT$ as a function of energy and of $d\sigma/d\Omega$ were calculated for both positive and negative pions. Corrections were made for errors resulting from pion decay in flight, the finite thickness of the target, nuclear interaction of pions in the target and absorber blocks, and background pions. The corrected values of $d\sigma/d\Omega dT$ are

T(Mev)	π^+ $d\sigma/d\Omega dT$	cm^2 Ster. Mev
9.2 ± 1.2	2.43	± 0.21 × 10^{-30}
17.8 ± 2.8	3.78	± 0.29
31.9 ± 1.9	3.16	± 0.21
51.5 ± 1.5	1.62	± 0.14
75 ± 5	0.77	± 0.06
118.6 ± 8.6	0.097	± 0.024

T(Mev)	π^- $d\sigma/d\Omega dT$	cm^2 Ster. Mev
9.6 ± 1.6	4.47	± 0.73 × 10^{-31}
17.8 ± 2.8	3.53	± 0.57
31.9 ± 1.9	3.19	± 0.36
51.5 ± 1.5	2.03	± 0.34
75 ± 5	0.41	± 0.12

The corrected integrated cross sections are $d\sigma/d\Omega(\pi^+) = 1.77 \pm 0.27 \times 10^{-28}$ cm^2/(ster nucleus) and $d\sigma/d\Omega(\pi^-) + 1.90 \pm 0.38 \times 10^{-29}$ cm^2/(ster nucleus), yielding a positive-negative ratio of 9.3 ± 2.3. An attempt has been made to interpret the positive pion spectrum in terms of existing information on the production of positive pions by protons on H. (auth)

5167
CAPTURE γ-RAYS FROM THE $Li^7(p,\gamma)$ REACTION AT THE 440-KEV RESONANCE. E. W. Titterton. Australian J. Sci. 15, 174-5(1953) Apr.

A thick Li-metal target was bombarded with 490-kev protons, and γ rays from the $Li^7(p,\gamma)$ reaction were detected by means of Li-loaded photographic plates utilizing the reaction $Li^7(\gamma,T)He^4$. The intensity ratio of the three lines observed at 12.5, 14.8, and 17.6 Mev was found to be 0.12 : 1.0 : 2.8. However, because of poor statistics and lack of exact knowledge of the energy dependence of the cross section, the intensity of the weak line can be regarded as accurate only within a factor of 2. The question of the state of Be^8 to which the 12.5-Mev γ ray corresponds is discussed, but no assignment is given pending further experiments. (L.M.T.)

5168
THE $O^{16}(\gamma,n)O^{15}$ AND $O^{18}(\gamma,p)N^{17}$ REACTIONS. R. Montalbetti and L. Katz. Can. J. Phys. 31, 798-803(1953) July.

The cross section for the $O^{16}(\gamma,n)O^{15}$ reaction has been determined by detecting the emitted neutrons, and the cross section for the $O^{18}(\gamma,p)N^{17}$ reaction has been determined by detecting the delayed neutrons following the decay of the N^{17} nucleus. Both cross sections exhibit a slowly rising portion for 3 Mev above threshold, followed by the usual large resonance-shaped curve. This anomalous behavior is discussed in the light of present photonuclear theories. (auth)

5169
PHOTO-ALPHA REACTIONS IN NUCLEAR EMULSIONS. C. H. Millar and A. G. W. Cameron. Can. J. Phys. 31, 723-57(1953) July.

In experiments to search for new photonuclear reactions involving the emission of heavy particles ($Z \geq 2$), Ilford E1 emulsions were exposed to 240 r of x radiation from the Saskatchewan Univ. betatron operating at energies up to 27 Mev. The plates were developed by a special "grain-gradation" technique which suppressed proton tracks and x-ray fog. The ejection of single α particles was observed from C^{13}, N^{14}, O^{16}, Ag, and Br. Multiple-pronged stars were

observed due to the photodisintegration of C^{12}, N^{14}, O^{16}, and probably Ag or Br. Interpretations of these events were deduced, and cross section vs. energy curves for many of them were obtained. Range-energy relationships were obtained for Be^9, B^{10}, and C^{12} particles in E1 emulsions. (auth)

5170

THE ANGULAR DISTRIBUTION AND YIELD OF NUCLEAR PHOTOPROTONS BETWEEN 20 AND 60 MEV FROM Be, C, Cu, AND Pb UNDER 150 MEV γ-RADIATION ENERGY. H. Hendel. Z. Physik 135, 168-95(1953) (In German)

The nuclear photoeffect in Be, C, Cu, and Pb under 150-Mev maximum γ-ray energy is investigated. The angular distribution curve of the photoprotons between 20 and 60 Mev is plotted for 125° and reaches a maximum at approximately 45°, and the angle between the γ ray and the proton emergence direction diminishes. The ascent of the angular distribution curve from 90° to the maximum is for the 50-Mev proton 1.5 times as great as for the 30-Mev proton. The drop of the curve from 90 to 120° is ~2 times as sharp for the fast proton. The maximum of the angular distribution is displaced with increasing proton energy in the direction of a smaller emergence angle. The angular distribution of the photoprotons of Be, Cu, and C is similar, and isotropic angular distribution is found for the heavy Pb. The effective cross section for 30- and 50-Mev protons is proportional to Z. (J.S.R.)

5171

INTERNAL CONVERSION IN THE L SUBSHELLS. J. B. Swan and R. D. Hill. Phys. Rev. 91, 424-5(1953) July 15.

Experimental determinations of L-subshell conversion coefficients for four cases of E2 transitions (Ta^{181}, Os^{186}, Hg^{198}, and Hg^{199}) and two cases of mixed M1 and M2 transitions (Ir^{191} and Tl^{203}), are presented, and comparison is made with theoretical conversions in the three subshells. The absolute values of the total L-shell coefficients obtained in various ways are given for the four E2 cases. Results indicate very good agreement between experimental and theoretical coefficients, and it is suggested that the values already published (Gellman et al., Phys. Rev. 85, 944(1952)) may be used with considerable confidence. (L.M.T.)

5172

DIPOLE PHOTONUCLEAR REACTIONS AND THE INDEPENDENT PARTICLE MODEL. James L. Burkhardt. Phys. Rev. 91, 420-1(1953) July 15.

Cross sections for the electric dipole photoexcitation of neutrons in an independent-particle-model nucleus were calculated as a function of photon energy. Characteristics of the potential well and bound neutron levels were chosen to correspond to the nuclide Cu^{63}, and antisymmetric nuclear wave functions made up from the exact single-particle solutions of Schroedinger's equation were used. When a smoothed version of the calculated photon-capture curve is compared with the observed photoneutron cross-section curve, the areas ($\int \sigma dE$) and shapes of the two curves are qualitatively similar, but most of the calculated absorption takes place at too low energy. A discussion is presented of possible reasons for this discrepancy. (L.M.T.)

5173

INVERSE OPPENHEIMER-PHILLIPS PROCESS IN THE Cu^{65} (He^3, α) REACTION. D. N. Kundu and M. L. Pool. Phys. Rev. 91, 417(1953) July 15.

Cu was bombarded with 13-Mev He^3 in a cyclotron, and 12.9-hr Cu^{64} was produced according to the reaction $Cu^{65}(He^3,\alpha)$. The excitation curve obtained is compared to that of the 9.4-hr Ga^{66} produced from the reaction $Cu^{65}(He^3, 2n)$. The $Cu^{65}(He^3,2n)$ curve fits smoothly a theoretical curve involving compound nucleus formation. The high-energy part of the $Cu^{65}(He^3,\alpha)$ reaction can be fitted to a theoretical curve down to ~9.0 Mev. For lower energies the shape of the curve changes in a marked way. The data indicate that the inverse Oppenheimer-Phillips phenomenon comes into evidence from very low energies up to an energy where compound nucleus formation takes over and, from there on, plays the major role in the $Cu^{65}(He^3,\alpha)$ reaction. (L.M.T.)

5174

NOTE ON SOME NEUTRON CAPTURE γ-RAYS FROM MAGNESIUM. B. B. Kinsey and G. A. Bartholomew. Can. J. Phys. 31, 901-2(1953) July.

Measurements were previously reported on energies and intensities of γ rays produced in Mg by neutron capture (Kinsey et al., Phys. Rev. 83, 519(1951)) and a γ ray, denoted by F, of 6.39 ± 0.05 Mev and intensity 5 photons/100 captures. It was not clear whether this ray was the ground state in Mg^{27} or the γ ray representing the transition to the second excited state of Mg^{25}. Using a more accurate apparatus in reinvestigating this γ ray, two γ peaks were found of energies 6.44 ± 0.008 and 6.358 ± 0.007 Mev. These correspond, respectively, to the energies of the ground-state γ ray of Mg^{27} and the γ ray representing the transition to the second excited state of Mg^{25}, from theoretical calculations. During the investigation the energy of the γ ray from neutron capture in Mg^{24} was accurately determined as 3.918 ± 0.004 Mev. (L.M.T.)

5175

THE STATISTICAL MODEL AND ANGULAR DISTRIBUTION. Otto Hittmair. J. phys. radium. 14, 270-1(1953) Apr. (In French)

The statistical model is too specific and simplified for the radial dependence of the wave function of the particle from the interior of the compound nucleus. Analysis of the angular distribution of the scattered particles or of the γ rays which result from inelastic scattering results in a broadening of the scope of the statistical hypothesis and permits an evaluation of the angular distribution in various levels of excitation. (J.S.R.)

5176

SOME REACTIONS CAUSED BY TRITONS IN LIGHT NUCLEI. P. Cüer and D. Magnac-Valette. J. phys. radium 14, 15S-16S(1953) Apr. (In French)

Tritons of ~2.7-Mev energy were used to bombard Li-charged emulsions. The deuteron emitted at a 70° angle to the incident triton has a long recoil and a measurable energy. Elastic collisions with O^{16} and N^{14} were observed. (J.S.R.)

5177

ANALYSIS OF PHOTONUCLEAR REACTIONS. Richard Wilson. Proc. Phys. Soc. (London) A66, 645-8(1953) July.

A method is described which enables photonuclear cross section curves to be derived from the appropriate yield curve with little ambiguity about assigning of errors. (auth)

5178

NEUTRON CAPTURE γ RAYS FROM DEUTERIUM. A. Bracci, U. Facchini, E. Gatti, E. Germagnoli, A. Malvicini, and G. Perona. Nuovo cimento (9) 10, 949-57(1953) July 1. (In English)

The spectrum of γ rays emitted in the reaction $n + p \rightarrow D + \gamma$ has been studied by means of a single crystal spectrometer and a pulsed neutron source. No γ lines whose energy is less than deuteron binding energy (2.23 Mev) have been observed within the limits of sensitivity of the detecting device; therefore the probable existence of a bound level of neutron-proton system, which was inferred by Nakagawa, is not confirmed. (auth)

PARTICLE ACCELERATORS

5179
Atomic Energy Research Establishment, Harwell, Berks (England)
THE ROUTINE PRODUCTION OF ZIRCONIUM-TRITIUM AND ZIRCONIUM-DEUTERIUM TARGETS. W. J. Arrol, E. J. Wilson, and C. Evans. Apr. 14, 1953. 11p. (AERE-I/R-1135)

The evaporation of Zr onto metal backings and its impregnation with D_2 or T_2 are described in detail. Thickness of Zr varies between 150 and 1,200 $\mu g/cm^2$, and the atomic ratio of hydrogen isotope to Zr is usually 1 : 1 and at best 1.5 : 1. (auth)

5180
Purdue Research Foundation
LINEAR ELECTRON ACCELERATOR: PROGRESS REPORT. June 15, 1953. 8p. (COO-165)

A traveling-wave linear accelerator was designed to operate in the $\pi/_2$-mode at 2853.78 Mc/sec. The accelerator waveguide consists of Ag-plated brass tubes with washers or irises placed every quarter wavelength along the guide. Electrons are injected at 50 kev. The phase velocity of the wave in the accelerator guide is increased in steps: the phase velocity is 0.70 the speed of light for the first 12.86 cm; it is 0.96 c for the next 104.3 cm; the phase velocity is c in the remainder of the accelerator. The accelerator is essentially two accelerators in tandem with a common source of power. The first half is designed to operate at a constant power input of 500 kw and yields a fixed energy of 4.0 Mev. The power to the second half may be varied to provide any desired energy increment from zero to some maximum value determined by the available power (2 Mev at present). The power source is a RK5586 magnetron which is capable of delivering 0.70 Mw to the accelerator. (auth)

5181
Microwave Lab., Stanford Univ.
EXTERNAL MAGNETIC FOCUSING DEVICES FOR THE MARK 3 ACCELERATOR. J. A. McIntyre, R. L. Kyhl, and W. K. Panofsky. July, 1953. 48p. (ML-202)

Beam loss in the 1-bev Stanford linear accelerator appears to be in excess of that predicted by theory. Theoretical calculations are presented in attempts to overcome this problem by strong-focusing applications. The theory of strong focusing is first applied to the accelerating region in a manner similar to that used by Bell (AERE-T/R-1114), after which the image-forming properties of a system of thin quadrupole lenses are examined. Some typical numerical results are presented for the 200-ft 1-bev electron accelerator. The achromatic double-prism deflection system in use at the 100- and 130-ft points, which is described in detail, transforms an essentially parallel, non-homogeneous beam into a beam converging to a focus. The possibilities of applying strong-focusing principles to this system so as to effect a parallel, rather than a converging, beam are discussed. (L.M.T.)

5182
Radiation Lab., Univ. of Calif., Berkeley
CONCERNING THE ABSOLUTE CALIBRATION OF THE BERKELEY SYNCHROTRON BEAM. Nelson Jarmie. Apr. 15, 1953. 5p. (UCRL-2185)

A 1950 calibration of the beam yielded a value of 14.7×10^{-8} equivalent quanta/nunan. The number of equivalent quanta is defined as the total energy in the beam divided by the maximum energy of the photons (in this case 322 Mev). Recent measurements give ~25% lower values and indicate another effect than just a macroscopic change between the old and new values. The value of the calibration, which should be a constant for various beam strengths, varies roughly as the ratio of the background to the beam. The observations indicate the need for a new monitoring system and stabilization and standardization of the synchrotron r-f system so that accurate beam calibration can be accomplished. (L.M.T.)

5183
Radiation Lab., Univ. of Calif., Berkeley
MAGNETIC DEFLECTOR FOR THE BEVATRON. Byron T. Wright. June 4, 1953. 13p. (UCRL-2238)

A magnetic deflector for the Bevatron is described. Particles initially circulating at some distance from the deflecting field are caused to enter the field during the course of a single turn because of a small energy loss in a suitably placed target. The estimated efficiency is about 1%/in.^{2} at a detector located 20 ft from the circulating current. (auth)

5184
THE BETATRON. Rolf Wideröe. Z. angew. Phys. 5, 187-200(1953). (In German)

A review of the betatron is presented, including its history, construction, operation, and potential applications. 70 references. (J.S.R.)

5185
FOCUSING OF HIGH ENERGY PARTICLES BY THE GRATING LENS. II. DEFECTS OF THE LENS. Michel Yves Bernard. J. phys. radium 14, 451-8(1953) July-Aug.-Sept. (In French)

The defects caused by the presence of a grating are discussed. It is impossible to obtain a lens with a continuous membrane. It is necessary to replace it by a grating with apertures as fine as possible. It is shown that the defects which result are not as important as they first appear and do not make the use of these lenses impossible as a focusing device. (tr-auth)

RADIATION ABSORPTION AND SCATTERING

5186
Naval Research Lab.
PENETRATION OF GAMMA RADIATION THROUGH IRON. L. A. Beach, R. B. Theus, and W. R. Faust. Apr. 9, 1953. 15p. (NRL-4145)

Measurements have been made on the penetration through Fe by Cs^{137}, Co^{60}, and Na^{24} γ radiation in plane parallel geometry. Good agreement was obtained between the experimental transmissions and theoretical values computed from Spencer's polynomial method. (auth)

5187
Naval Research Lab.
EFFECT OF ANGLE OF INCIDENCE UPON PENETRATION OF GAMMA RADIATION. E. H. Bebbs, R. H. Vogt, and W. R. Faust. Apr. 16, 1953. 13p. (NRL-4165)

Experiments have been performed to observe the manner in which the penetration of γ radiation through a thick barrier depends upon the angle of incidence of the radiation. Experimental data are compared with a simplified theoretical description of the multiple scattering process, and qualitative agreement is found relative to dependence upon both shield thickness and angle of incidence. (auth)

5188
Rochester Univ.
THE SCATTERING OF 40 MEV POSITIVE PIONS BY HYDROGEN. J. P. Perry and C. E. Angell. July 6, 1953. 8p. (NYO-3827)

Data are presented on the experimental determination of the differential scattering cross sections of H for 40-Mev positive pions at angles of 45, 60, 90, 120, and 140°. The scatterer and counter geometries are given. (K.S.)

5189

Radiation Lab., Univ. of Calif., Berkeley

ELASTIC SCATTERING OF 190 MEV DEUTERONS BY PROTONS. Owen Chamberlain and Martin O. Stern. June 3, 1953. 34p. (UCRL-2236)

The elastic differential-scattering cross section of 190-Mev deuterons by protons has been measured from 15 to 170° in the center-of-mass system. The cross sections were obtained by subtracting the C counts from those received with a polyethylene target. The experiments are described, and the results are compared with those expected from theory by making use of a method developed by Chew. (Phys. Rev. 84, 1057(1951)). (auth)

5190

COHERENT SCATTERING OF X-RAYS AND HIGH-SPEED ELECTRON RAYS BY ATOMS. THE ATOMIC FORM-FACTOR. R. Gáspár. Acta Phys. Acad. Sci. Hung. 3, No. 1, 59-63(1953).

Various methods are described for determining the atomic form factor, which is useful in the theory of coherent scattering of x rays and electrons. It is shown how the atomic form factors, the most correct known so far based on the densities determined by the self-consistent field method, can be generalized for elements for which similar calculations are not yet known. (auth)

5191

THE RELATIVE STOPPING-POWER OF HYDROGREN AND OF HELIUM FOR SLOW α-PARTICLES. P. N. Cooper, V. S. Crocker, and J. Walker. Proc. Phys. Soc. (London) A66, 658-9(1953) July.

Because of charge-exchange uncertainties it was thought unlikely that the difficulties encountered in stopping-power determinations could be resolved by theoretical analysis; therefore, careful measurements were made in a Wilson cloud chamber. Stereophotographs were taken with a large angle (~25°) between the views, and range measurements were made on the reprojected images. An air-absorber cell was attached to the wall of the cloud chamber and separated from the chamber by a thin mica window ($\frac{1}{2}$ cm air equivalent). A known portion of the range of Po α particles was absorbed in the air cell and window, and the residual range was measured in the chamber. From the chamber conditions the relative stopping powers of He and H at standard conditions were found for each track, the residual range being corrected for those particles not passing through the cell normally. The results are compared with those of previous investigators. (L.M.T.)

5192

RANGE-ENERGY DATA FROM THE $^{10}B(n,\alpha)^7Li$ AND $^6Li(n,t)^4He$ REACTIONS. P. N. Cooper, V. S. Crocker, and J. Walker. Proc. Phys. Soc. (London) A66, 660-1 (1953) July.

From the stopping power information on He and H for slow α particles (see preceding abstract) the mean air ranges of the particles emitted in the slow-neutron reactions $B^{10}(n,\alpha)Li^7$ and $Li^6(n,t)He^4$ were obtained. The reactions were investigated in a 9-in.-diameter Wilson cloud chamber by use of the slow neutrons which pass through the shielding of the Birmingham cyclotron. For the boron reaction, H and He were used as the chamber gas, and air was used for the Li work. A gaseous target (boron ester $B(OCH_3)_3$) was used, and the cyclotron was pulsed in synchronism with the cloud chamber. A value of 1.62 ± 0.1 was obtained for the ratio of α particle to Li^7 ranges, and the final range for the α particles was 0.725 ± 0.007 cm. The associated energy for this range is 1.47 ± 0.01 Mev. In the Li reaction, a thick source of enriched $Li_2SO_4 \cdot 2H_2O$ on Ni was used, and the extrapolated triton range was measured from the number-range curve. By comparison with the Po α particles the mean range of the tritons was found to be 5.97 ± 0.5 cm, corresponding to an energy of 0.910 ± 0.004 Mev. (L.M.T.)

5193

A COVARIANT NON-ADIABATIC EQUATION FOR NUCLEON-PION SCATTERING. S. Fubini. Nuovo cimento (9) 10, 851-4(1953) June 1. (In English)

A covariant integral equation for the Feynman kernel of the nucleon-pion scattering is proposed for study of nucleon-pion scattering with isotopic spin state $T = \frac{1}{2}$. The equation has a formal analogy to the Bethe-Salpeter equation for the p-n system. By use of Dyson's procedure, the divergent parts can be isolated and ruled out by means of renormalization of the nucleon mass and of the coupling constant. (J.S.R.)

5194

PROTON STOPPING POWER AND ENERGY STRAGGLING OF PROTONS. C. B. Madsen. Kgl. Danske Videnskab. Selskab Mat.-fys. Medd. 27, No. 13, 1-21(1953). (In English)

The energy loss and straggling of protons in foils of mica, Be, Al, Cu, Ag, and Au are determined as a function of proton energy in the range of 0.1 to 2 Mev. Straggling is determined from a broadening of the resonance curves obtained when a foil is inserted in the beam. Energy loss in the foil is determined from the resonance shift to higher voltages which accompanies the foil insertion. (K.S.)

5195

A FORMULA FOR THICK TARGET BREMSSTRAHLUNG. Richard Wilson. Proc. Phys. Soc. (London) A66, 638-44 (1953) July.

Corrections to the Bethe-Heitler formula for thin-target bremsstrahlung are calculated for the degradation of the electrons in a thick target by ionization and radiative losses. The calculations apply only to the cross section integrated over all angles, and the accuracy of the formula is discussed. (auth)

5196

RESONANT NUCLEAR SCATTERING OF ^{198}Hg GAMMA-RAYS. P. B. Moon and A. Storruste. Proc. Phys. Soc. (London) A66, 585-9(1953) July.

The resonant scattering has been measured using the original principle of Doppler shift produced by mechanical motion but with a quite different experimental arrangement. The intrinsic width of the 0.411-Mev excited state is estimated to be $\sim 5 \times 10^{-6}$ ev, corresponding to a half life of $\sim 8 \times 10^{-11}$ sec. The difference from the first estimate ($T \sim 10^{-11}$ sec) is mainly due to the statistical weight factor of 5 resulting from the now well-established spin of the excited state. This factor causes the resonant-scattering values to differ considerably from the most recent direct measurement of the half life, $(1.0 \pm 1.7) \times 10^{-11}$ sec, and possible causes of the discrepancy are discussed. (auth)

5197

EFFECT OF CAPTURE ON THE SLOWING-DOWN LENGTH OF NEUTRONS IN HYDROGENOUS MIXTURES. Howard C. Volkin. Phys. Rev. 91, 425-6(1953) July 15.

Fermi (Ricerca sci. 7, 13(1936)) derived a rigorous expression for the slowing-down length of neutrons, L_s, for the case of hydrogenous media, under the assumptions that the nonhydrogen nuclei have infinite mass and that capture is absent. A generalization of Fermi's result which takes into account capture but still retains the assumption of infinite mass for the nonhydrogen nuclei is presented. The resulting changes in the magnitudes of L_s due to capture are presented for the case of a $B_2O_3-H_2O$ mixture. (L.M.T.)

5198

INELASTIC EVENTS OF PROTONS AT HIGH ENERGY IN NUCLEAR EMULSIONS. M. Ladu. Nuovo cimento (9) 10,

855-7(1953) June 1. (In Italian) (cf. NSA 7-2144)

Ilford G5 emulsions were exposed to the 240-Mev proton beam of the Rochester cyclotron, and 5,027 cm of tracks were subsequently analyzed in detail. The number of fast prongs and inelastic scattering cross section are tabulated. Nuclear transparency to 240-Mev protons was found. (J.S.R.)

5199

THE INCOHERENT SCATTERING OF X RADIATION. Friedrich Lenz. Z. Physik 135, 248-50(1953). (In German)

The scattering function for x radiation is calculated by the Thomas-Fermi approximation and by the Molière approximation. A graph compares the results. The Molière approximation follows the Thomas-Fermi except for small scattering angles. (J.S.R.)

5200

SCATTERING OF HIGH-ENERGY ELECTRONS AND THE METHOD OF NUCLEAR RECOIL. R. Hofstadter, H. R. Fechter, and J. A. McIntyre. Phys. Rev. 91, 422-3(1953) July 15.

A method is described for studying the elastic scattering of electrons in compounds or with unseparated isotopes. The external electron beam of the Stanford linear accelerator is resolved in energy to ~1%, deflected, cleared of γ rays, and focused in vacuum at the center of a 20-in. diameter scattering chamber. Scattered electrons emerge from remotely controlled targets within the chamber, pass through a 0.006-in. Al window of the chamber, and through a 0.003-in. Al foil into the vacuum chamber of a double-focusing magnetic spectrometer. The spectrometer has a radius of 16 in. and bends electrons of 135 Mev (maximum) through 180°. Each isotope present in the scatterer presents its own elastic peak. Scattering curves are shown for Be and polyethylene targets. In addition, a preliminary angular distribution curve was obtained for Au by using the peak intensity of the elastic curves as a measure of the scattering cross section. (L.M.T.)

5201

OBSERVATIONS ON THE BORN-OPPENHEIMER APPROXIMATION FOR THE TREATMENT OF IMPACT PROBLEMS. Karl Wildermuth. Z. Naturforsch. a8, 284-92(1953) May. (In German)

By use of a simple example, the analytical structure of the Oppenheimer approximation method for the solution of nuclear particle impact problems is investigated. It is proved that this method in its original formulation allows no approximation for the distinction of like particles (analog to the Born method). The modification of these methods to allow for distinction is briefly discussed. The elastic-scattering cross section of the example is derived using the different approximations for comparative purposes. (tr-auth)

RADIATION EFFECTS

5202

Massachusetts Inst. of Tech.

X-RAY STUDY OF RADIATION DAMAGE. B. E. Warren. June 30, 1953. 4p. (NYO-3734)

The development of x-ray-diffraction methods for measuring and evaluating the nature of radiation damage in materials and the application of these methods to typical metals, alloys, and inorganic compounds are presented. (J.E.D.)

5203

ON THE IONIZATION LOSS OF A FAST PARTICLE IN A DIELECTRIC MEDIUM. G. N. Fowler and G. M. D. B. Jones. Proc. Phys. Soc. (London) A66, 597-600(1953) July.

A difficulty which has arisen in the physical interpretation of the theory of the ionization loss by fast particles on passing through matter is discussed, and it is shown how it is resolved by using a more general expression for the dielectric constant. (auth)

RADIOACTIVITY

5204

Laboratory for Nuclear Science [and Engineering], Mass. Inst. of Tech.

BETA-DECAY ENERGETICS AND NUCLEAR SHELL STRUCTURE. Charles D. Coryell. [June 1953] 17p. (NYO-3590)

Quantitative analysis of radioactive-decay data shows that β energies have parabolic dependence on Z within a given shell region. The locus of the energy minimum Z_A is linear with A but shows offsets crossing shell edges and discontinuities in proton or neutron binding. A fair representation of the curvature B_A is given as 78.0 Mev/Z_A except for $A > 180$, where it is 1.16 Mev. There is a pairing term ϵ_A accounting for differences in stabilities of odd protons and odd neutrons which occurs just above a few shell edges. Substitution of these parameters in the equation $Q^\beta = B_A(Z_A - Z - 0.5)$ + pairing term permits the precision of about 0.2 Mev from $40 < A < 245$ and explains the absence of stable odd-A isotopes for Tc, Ce, and Pm. The decay of even-A species is also regulated by a more prominent omnipresent pairing term δ_A enhancing the decay energy of odd-Z members and diminishing the decay of even-Z members. Predictions of the decay of even-A species by the above equation is good to about 0.5 Mev. (auth)

5205

Oak Ridge National Lab.

1-3 γ-CORRELATION WITH MIXTURES AND POLARIZATION. R. K. Osborn and M. E. Rose. Issued July 22, 1953. 12p. (ORNL-1560)

Calculations are given to show the modifications induced in the γ-γ angular correlation function by mixed intermediate radiations, i.e., to compare the 1-3 correlation with mixed, unobserved intermediate radiation with the usual 1-2 correlation. The processes under consideration consist of a nuclear transition from state (j_0m_0) to state (j_1m_1) accompanied by the emission of a γ ray described by propagation vector k_1 and polarization vector ϵ_1, a nuclear transition $(j_1m_1) \rightarrow (j_2m_2)$ accompanied by emission of a γ ray k_2, ϵ_2, and nuclear transition $(j_2m_2) \rightarrow (j_3m_3)$ accompanied by emission of γ ray k_3, ϵ_3. (J.A.G.)

5206

SCINTILLATION-SPECTROMETER STUDY OF THE RADIATIONS OF Zn^{65}. Nils Perrin. J. phys. radium 14, 273-4(1953) Apr. (In French)

The γ radiation accompanying the disintegration of Zn^{65} has been investigated. A γ ray of 1.1 Mev represents the transition to Cu^{65} and has an intensity of 31 ± 5. The 200-kev γ ray of Zn^{65} has an intensity less than 3.1×10^{-3}. (J.S.R.)

5207

EXCITATION OF THE ELECTRON CORTEGE INDUCED BY α AND β EMISSIONS. P. Benoist-Gueutal. J. phys. radium. 14, 6S(1953) Apr. (In French).

A theoretical study of the effects of α and β emission on the electron cortege shows that the atom will be in an excited state or be partially ionized internally after the particle emission. The probability of β emission causing a given excited state for the atom is discussed, as is α emission causing partial internal ionization. (J.S.R.)

5208

ALPHA-EMITTING LEVELS OF ^{8}Be WITH ISOTOPIC SPIN

T = 1. J. J. Wilkins and F. K. Goward. Proc. Phys. Soc. (London) A66, 661-2(1953) July.

The authors recently reported the existence of a 16.9-Mev level of Be^9 which decays by emission of α particles. Ajzenburg and Lauritsen (Revs. Mod. Phys. 24, 321(1952)) point out that both the excitation energy and narrow width of this level suggest that it is the isotopic spin T = 1(T_z = 0) analogue of the ground states of Li^8 and B^8, and its properties are therefore of special interest. The present communication gives a preliminary account of further work which confirms the (predominantly) T = 1 character of the level and demonstrates that the total angular momentum J is 2(both parity and J must be even to permit decay into α particles). The existence of a further α-emitting level at 17.6-Mev excitation is also reported. (auth)

5209

THE ABSOLUTE STANDARDIZATION OF THE 2.615 MEV γ-RAYS OF ThC'' AND THE CROSS SECTION FOR THE PHOTODISINTEGRATION OF THE DEUTERON AT THIS ENERGY. P. Marin, G. R. Bishop, and H. Halban. Proc. Phys. Soc. (London) A66, 608-16(1953) July.

The absolute number of short- and long-range α particles from a source of active deposit of Tl^{208} (0.6 mc) has been determined by counting, with an ionization chamber, in low geometry. This measurement gives a new value for the branching ratio (0.354 ± 0.004) and at the same time the absolute number of 2.615-Mev γ rays emitted by this source (0.384 ± 0.009 mc/mg Ra equivalent of active deposit). The same source has then been compared with a standard Ra source on a Curie-type ionization chamber. The procedure for future absolute calibration is in this way simplified. The increased precision of these measurements leads to a revision of former determinations of the cross section for the photodisintegration of the deuteron at 2.615 Mev. This new cross section is (13.80 ± 0.38 × 10^{-28} cm^2. (auth)

5210

THE DECAY OF Mg^{28}. A. H. Wapstra and A. L. Veenendaal. Phys. Rev. 91, 426(1953) July 15.

All of the results on the Mg^{28} decay scheme agree essentially with those of Sheline and Johnson (Phys. Rev. 90, 325(1952)). Sheline and Johnson, however, could not determine the energy or intensity of the ~30-kev γ ray. An energy of 32.2 kev for this ray has been derived from a scintillation spectrum. Its intensity was compared with the total intensity of the photopeak and Compton pulses of all higher-energy γ rays, and assuming the intensity ratios of these γ rays as determined by Sheline and Johnson, a value of 0.7 ± 0.2 32-kev γ's per decay of Mg^{28} was found. The 32-kev γ ray is thought to be an M1 transition. (L.M.T.)

5211

THE DECAY OF Re^{188} AND THE LIFETIMES OF Os^{186m} AND Os^{188m}. C. C. McMullen and M. W. Johns. Phys. Rev. 91, 418-19(1953) July 15.

The γ spectrum of Re^{188} was investigated by use of a double-focusing β spectrometer with resolution of 0.7%. The γ rays were converted in a 19 mg/cm^2 Pb radiator, and the energy determinations were made by comparing the point of inflection on the sharp, high-energy edge of each peak with the external conversion peaks produced by the well-known γ rays of Pb^{212}, Cs^{137}, and Co^{60}. The relative intensities of the 8 γ rays were calculated from the photoelectron peak heights and the known dependence of photoelectron cross section on energy. A proposed decay scheme is presented using the γ energies and intensities determined from the investigation. In the course of the investigation the lifetimes of the 0.155-Mev excited state of Re^{188} and the 0.137-Mev excited state of Os^{186} were determined. (L.M.T.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

5212

Radiation Lab., Univ. of Calif., Berkeley

CRYSTAL STRUCTURES OF RARE EARTH OXYCHLORIDES. D. H. Templeton and Carol H. Dauben. May 25, 1953. 9p. (UCRL-2230)

Lattice dimensions are reported for YOCl, LaOCl, CeOCl, PrOCl, NdOCl, SmOCl, EuOCl, GdOCl, TbOCl, DyOCl, HoOCl, and ErOCl, which have the tetragonal PbFCl-type structure. Atomic parameters are given for SmOCl and HoOCl. TmOCl, YbOCl, and LuOCl have a different structure which has not been determined. ErOCl is dimorphic and has been found in both structures. (auth)

5213

THE SPLITTING OF THE Pr^{+++} TERM AND THE SYMMETRY OF THE CRYSTAL FIELDS IN TRIGONAL SINGLE CRYSTALS OF PRASEODYMIUM SALTS. A. M. Hellwege and K. H. Hellwege. Z. Physik 135, 92-100 (1953). (In German) (cf. NSA 6-1272)

By lowering the temperature from 58 to 14°K, a double line of group $^3H_4 \rightarrow {}^3P_2$ was resolved. From the complete structure of this line group, the splitting results from the $^3P_2$ terms in the trigonal crystal field. The symmetry of this field was determined from the intensity of the π component to C_{3v}. The quantum numbers μ and $\bar{\nu}$ of the electron state are indicated. The crystal field is closer to the octahedral limiting case than to the axial-symmetrical one. The probable position of the ions in the crystal cell is indicated. (tr-auth)

SPECTROSCOPY

5214

University of Southern Calif.

ISOTOPE SHIFT AND NEW FINE STRUCTURE IN NEUTRAL ATOMIC OXYGEN. John R. Holmes and Lee W. Parker. June 15, 1953. 67p. (NP-4657; Technical Report 5)

Data on 20 atomic lines of O^{18} are presented in order to study the consistency of measured shifts as a test of the mass-effect theory. It is concluded that the theory is generally valid for O. A comparison is made with earlier N data. New fine structure was resolved in the lines λ8446, λ4368, λ2884. (K.S.)

5215

Spectroscopy Lab., Mass. Inst. of Tech.

PRECISION MEASUREMENT OF WAVELENGTHS WITH ECHELLE SPECTROGRAPHS. George R. Harrison, Sumner P. Davis, and Hugh J. Robertson. June 1, 1953. 36p. (NYO-3409)

Dispersive properties of echelles having a concave grating in a stigmatic mount are discussed. A precision to about 1 part in 5 × 10^6 was attainable with the echelle. A method is described by which the interference of the spectral lines on an echellegram can be computed. On division by three-figure integral values of interference, wavelengths can be obtained to within ~0.001A throughout the visible and ultraviolet spectrum with little added complexity beyond that required for reducing grating spectrograms and with greater precision, compactness, and spectrum coverage on a single plate. A discussion of the error of coincidence is included since it now affects the accuracy attainable with a single fiducial line and 2 or 3 Hg^{198} lines, when substituted for the large number of standard lines needed for precision wavelength determinations with concave gratings. (J.A.G.)

5216

THE VIBRATION SPECTRA OF BORON TRIMETHYL AND OF BORON TRIMETHYLENE AMMONIATE (TRIMETHYLAMMINO BORINE). J. Goubeau and H. J. Becher. Translated from Z. anorg. u allgem. Chem. 268, 1-12(1952). 11p.

(AEC-tr-1549; AERE/tr-11/3/5/245)

The Raman spectrum and the infrared spectrum of $B(CH_3)_3$ and the Raman spectrum of $B(CH_3)_3NH_3$ were observed, for the purpose of studying the chemical binding in B compounds. The spectra are interpreted, and from them the force-constants are calculated with simplified potential expressions. In contrast to BF_3, the transition to fourfold co-ordination in $B(CH_3)_3$ does not cause a lowering of the valency force constant which in both cases corresponds to the value of a single bond between B and C. (auth)

5217

VARIATIONAL PRINCIPLES AND THE VIRIAL THEOREM IN PROBLEMS OF CONTINUOUS SPECTRA IN QUANTUM MECHANICS. Yu. N. Demkov. Translated from Doklady Akad. Nauk S.S.S.R. 89, 249-52(1953). 4p. (NSF-tr-21; D-89-249)

Variational methods are applied to the equation for the radial function describing S-scattering by a center of force. Generalizations of the virial theorem for the case of continuous and discrete spectra are obtained. (K.S.)

5218

INDIRECT DETERMINATION OF THE COEFFICIENTS OF FLUORESCENCE FOR THE K LEVEL OF CERTAIN ATOMS BY X RAY WIDTH MEASUREMENT. Williams Laskar. Compt. rend. 233, 2149-50(1953) June 1. (In French)

The fluorescent coefficient for K-level transitions is evaluated for elements of atomic number 37 to 50. The width of the K level is first determined from the K_{α_1} line. The probability of a return to the stable state by radiative and Auger transition is then evaluated by assuming the Auger transition to be independent of Z. The value of ΔE_A for an Auger transition is thus 1.7 ev, and the fluorescent coefficient is then calculated from known values of ΔE for various elements. (K.S.)

5219

A "MAGNETIC SCANNING" METHOD FOR INVESTIGATING HYPERFINE STRUCTURE AND ISOTOPE SHIFT. F. Bitter, H. Plotkin, B. Richter, A. Teviotdale, and J. E. R. Young. Phys. Rev. 91, 421(1953) July 15.

The 2537A radiation emitted axially from a Hg^{198} lamp in a magnetic field is passed through a quarter-wave plate and Nicol prism adjusted so as to pass only one of the two σ components of the normal Zeeman triplet. Since the frequency displacement of this component depends linearly on the field, this arrangement provides a monochromatic light source of variable frequency. This light is used to excite selectively the hyperfine components of the resonance radiation of the isotopes in the Hg vapor being investigated. Fields up to 10,000 gauss vary the frequency over a range sufficient to cover the entire hfs pattern of the resonance line of natural Hg. The intensity of the resonance radiation is observed with a photomultiplier. The effective resolving power of this arrangement is limited only by the width of the radiated and absorbed lines. (auth)

THEORETICAL PHYSICS

5220

EQUATIONS OF MOTION AND FIELD EQUATIONS IN THE FIVE-DIMENSIONAL UNITARY THEORY OF RELATIVITY. R. S. Ingarden. Translated from Doklady Akad. Nauk S.S.S.R. 88, 773-7(1953). 5p. (NSF-tr-26; D-88-773)

The relativistic-gravitational theory of Fock is discussed from the standpoint of reconciling this view with that of Einstein and Infeld. Fock considers the theory of relativity to be a gravitational theory alone, applicable only on an astronomic scale. The energy-momentum tensor is therefore introduced in a theory of finite masses, approached by the use of five-dimensional relativity. It is shown that the equations of motion follow from the new field, without additional assumptions concerning matter. Several consequences of the five-dimensional energy-momentum tensor are discussed. (K.S.)

5221

THE NEUTRON-PROTON SYSTEM WITH A CENTRAL EXPONENTIAL POTENTIAL. I. P. O. Brundell and B. Enander. Acta Polytech. Phys. Appl. Math. 2, No. 4, 1-14 (1953).

The interaction between a neutron and a proton in the ^3S and ^1S state is assumed to be described by a central potential of the form $-B \cdot e^{-\lambda r}$. It is further assumed that the range of the potential, $1/\lambda$, is the same in these two states, but that the depth, B, is different: B_t and B_s. Exact expressions for the deuteron binding energy, $|E_0|$, the epithermal scattering cross section, σ_0, and the coherent scattering amplitude, f, have been derived. For two combinations of the parameters B_t, B_s, and λ the theoretical and experimental values of $|E_0|$, σ_0 and f agree. Calculations of the effective range, r_0, of the potential have shown that one of these is physically unacceptable as it gives a too large r_0. Choosing the other system of parameters, the scattering cross section has been calculated by means of the effective range method in the energy region, where the contribution from the P states can be neglected (up to 5 Mev). The results agree with recent measurements within the experimental errors. Finally the capture cross section has been computed. (auth)

5222

STRUCTURE AND MASS SPECTRUM OF ELEMENTARY PARTICLES. I. GENERAL CONSIDERATIONS. Hideki Yukawa. Phys. Rev. 91, 415-16(1953) July 15.

Conclusions reached with the present nonlocal field theory have proved unsatisfactory in many respects. Among other things, the masses of the particles associated with the irreducible nonlocal fields remained completely arbitrary and simple, and plausible assumptions concerning the interaction between fields did not result in the expected convergence of self-energies. The disappointing consequences are not inherent in nonlocal field theory, in general, but are related to the particular type of field to which the investigation is restricted. Less restricted nonlocal fields are first considered, and the general method of reducing the theory of nonlocal interaction between local fields is discussed. (L.M.T.)

5223

STRUCTURE AND MASS SPECTRUM OF ELEMENTARY PARTICLES. II. OSCILLATOR MODEL. Hideki Yukawa. Phys. Rev. 91, 416-17(1953) July 15.

A four-dimensional oscillator model for the elementary particle is discussed, which is similar to that considered by Born in connection with his idea of self-reciprocity (Proc. Roy. Soc. (Edinburgh) 62, 470(1949); Revs. Mod. Phys. 21, 463(1949)). However, the model discussed here introduces internal degrees of freedom of the particles which are related to the nonlocalizability of the field itself. (L.M.T.)

5224

THE RELATIONSHIP OF THE QUANTUM THEORY TO THE THEORY OF GRAVITATION AND ELECTROMAGNETISM AND AN APPLICATION TO THE THEORY OF ELECTRONS. H. T. Flint and E. Marjorie Williamson. Z. Physik 135, 260-9(1953). (In German)

By means of a geometry in which the linear element is produced by a matrix and the assumption of a method similar to that of Weyl, it is shown that equations in the form of the Dirac equation can be conceived as standard equations. Their role in the theory is comparable to that of the gravitation law in the relativity theory. This theory is summarized with the field theory of Kaluza. A relation-

ship is thus given between the spheres of gravitation electromagnetism, and the quantum theory. By this combination of geometry and metric for the field of microscopic physics a theory of electrons is expected. (tr.-auth)

5225

DERIVATION OF THE QUANTUM THEORY FROM A CLASSICAL MODEL. W. Weizel. Z. Physik 135, 270-3 (1953). (In German)

The derivation of the quantum theory from a classical diffusion model was expanded to include elementary particles. This expansion holds up, not only in an electrical field, but also in a magnetic field. (tr-auth)

5226

DERIVATION OF THE MATHEMATICALLY QUIVALENT TENSOR EQUATION FROM THE DIRAC SPIN EQUATIONS FOR THE WAVE FIELD OF ELEMENTARY PARTICLES OF NON-VANISHING MASS AND ANY WHOLE QUANTUM NUMBER. Hermann Donnert. Acta Phys. Austriaca 7, 181-97(1953). (In German)

The formulas for tensor and spin calculations are analyzed in the fourth dimensional space-time continuum. The resulting equations are applied to the Dirac wave-field equations. Transformation of the tensor equations permits inversion of the motion derivatives to give equivalent tensor equations for the wave field of elementary particles. (J.S.R.)

5227

DIFFERENTIAL CONSERVATION LAWS IN NON-LOCAL FIELD THEORIES. J. Rzewuski. Nuovo cimento (9) 10, 784-802(1953) June 1. (In English)

The extent to which conservation laws are satisfied in non-local field theories is investigated. It is shown that, from the invariance of the action integral with respect to gage transformations of the first kind, translations and rotations of space-time follow the integral conservation laws. These integral laws show that certain functionals of a space-like surface σ have equal values at the boundaries σ_1 and σ_2 of the domain of space-time considered in the problem. These functionals have the disadvantage of being inconstant in the region between σ_1 and σ_2. Another disadvantage is that they do not correspond with the local charge, momentum, and angular momentum. It is shown further that, starting with the Euler-Lagrange field equations, it is possible to construct other functionals of σ constant throughout the region (σ_1, σ_2) and satisfying at the same time the correspondence principle. These functionals may, therefore, be interpreted as the total charge, momentum, and angular momentum of the non-local system. The integral conservation laws follow from the differential laws if the condition of invariance with respect to the three types of transformations is satisfied. The general considerations are illustrated on a simple example of a non-local field theory. (auth)

5228

LIMIT OF THE POSSIBILITY OF LOCALIZATION BY RECIPROCAL EFFECTS IN THE QUANTUM THEORY OF ELEMENTARY PARTICLES AND FIELDS. Hermann L. Jordan. Z. Naturforsch. a8, 341-52(1953) June. (In German)

The present investigation shows that the hypothesis of a limit to the possibility of localization by reciprocal effect indicating "the smallest length" makes possible a consistent and convergent quantum theory. By use of mathematical invariant considerations, a functional transformation G is determined by means of simplifying assumptions by which, in the usual theory, a limit of the possibility of localization is introduced. The same transformation is obtained from the Heisenberg uncertainty principle when the conditions of minimum uncertainty are found. It is further shown that a specialization of the transformation G yields a field theory which in the usual scheme of the quantum theory classifies the wave field. This method can be used for interpretation by the regularization process. (tr-auth)

5229

A GENERAL THEORY OF THE SECOND QUANTIZATION METHODS. M. Schönberg. Nuovo cimento (9) 10, 697-744 (1953) June 1. (In English)

It is shown that the second quantization methods are a general mathematical technique applicable to formalisms involving linear equations of change, differential with respect to the time variable. The ordinary second quantization formalism for systems of bosons or fermions, and the second quantization of the classical theory developed by the author are obtained as particular cases of the general methods. There are several ways of applying the second quantization methods to the same linear problem, which lead to different formalisms. A very simple kind of second quantization is applied to the Schroedinger equation of an arbitrary mechanical system in order to develop a new treatment of the statistical quantum mechanics (the Gibbs second quantization). In this way a straightforward method of introducing the Gibbs ensembles and grand ensembles is obtained. The entropy is discussed with the Gibbs second quantization. Some ergodic theorems of the general second quantization and the quantum mechanics are derived. (auth)

5230

MASS-RENORMALIZATION WITH THE TAMM-DANCOFF METHOD. F. J. Dyson. Phys. Rev. 91, 421-2(1953) July 15.

In an earlier letter (Phys. Rev. 90, 994(1953)) a modified form of the Tamm-Dancoff method was proposed. It was shown that certain divergence problems connected with the self-energy of the vacuum, which are troublesome with the old TD method, are absent with the new TD method. In this letter the separate divergence problem connected with the self-energy of a single particle is discussed. (auth)

5231

BREMSSTRAHLUNG AT HIGH ENERGIES. H. A. Bethe, L. Maximon, and F. Low. Phys. Rev. 91, 417-18(1953) July 15.

Maximon and Bethe (Phys. Rev. 87, 156(1952)) derived a formula for the cross section for bremsstrahlung without the use of Born approximation. In the matrix element, both wave functions of the electron in the coulomb field of the nucleus were taken to be plane waves plus outgoing spherical waves. This note points out that this is correct for the initial state ψ_i, but that the final state ψ_f should be taken as a plane wave plus ingoing spherical waves. (L.M.T.)

PATENTS

CHEMISTRY

5232

FLOTATION OF URANIUM. P. L. Veltman (to U. S. Atomic Energy Commission). U. S. Patent 2,647,629, August 4, 1953.

This invention relates to a process for the separation of U values from ores by an improved flotation procedure. The process is effected by using, in a conventional flotation procedure, a combination of flotation agents comprising a detergent and a soluble salt of a fatty acid or a rosin acid. The advantage of the process lies in improved recoveries of the U values and the ease of breaking the foam by conventional techniques.

5233

MULTI-STAGE MIXER-SETTLER APPARATUS. B. V.

Coplan and E. L. Zebroski (to U. S. Atomic Energy Commission). U. S. Patent 2,646,346, July 21, 1953.

This patent describes a multistage mixer-settler unit wherein the flow of liquids under treatment is co-current in each stage while the flow through the entire unit is countercurrent. The apparatus utilizes a centrifugal impeller to provide fluid flow, interface control, and mixing action. This impeller is used in combination with an arrangement of horizontal and vertical plates which permits high mixing efficiency while maintaining good interface control.

5234

IMPLEMENT FOR USE IN CHEMICAL APPARATUS. C. H. Prescott, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,639,074, May 19, 1953.

This patent describes an apparatus for packaging a volatile, hygroscopic substance, such as UCl_4, comprising an arrangement for charging one of a number of containers with the given substance while simultaneously hermetically sealing another of the containers, all of the operations being conducted without exposing the hygroscopic substance to the atmosphere.

ENGINEERING

5235

SEALED TELESCOPIC PIPE JOINT. O. E. Tollefsbol (to U. S. Atomic Energy Commission). U. S. Patent 2,647,770, August 4, 1953.

This patent relates to sealed joints and metallic gaskets therefor, adapted to operate under extremely vigorous conditions of temperature and pressure. The device comprises a hollow ring gasket of a resilient metal and is formed so as to be non-symmetrical with respect to a median transverse plane. The invention is peculiarly adapted for use where the associated pipes are exposed to varying degrees of contraction and expansion in addition to vibrational stresses.

PHYSICS

5236

AUTOMATIC TEMPERATURE REGULATOR. M. L. Sands (to U. S. Atomic Energy Commission). U. S. Patent 2,646,544, July 21, 1953.

This invention relates to a very sensitive control system having the capability of maintaining a selected temperature within a minute fraction of a degree. The device utilizes a Wheatstone bridge circuit including two high-temperature- and two low-temperature-coefficient resistors. A departure in temperature from the desired amount unbalances the bridge. The potential derived from the bridge is mixed with the applied potential thereby giving a resultant algebraic sum or difference in accordance with the direction of drift. The resultant potential is utilized to control a temperature-restoring heat source.

5237

ELECTRIC INTEGRATOR. M. Bevis (to U. S. Atomic Energy Commission). U. S. Patent 2,646,925, July 28, 1953.

This invention relates to an electronic circuit for integrating the intervals of duration of electrical pulses. Specifically the apparatus may be employed for indicating the outage time due to sparking which has occurred in a run of an isotope-separating unit of the electromagnetic type.

5238

ULTRA-WIDE BAND AMPLIFIER TUBE. C. Sheer (to U. S. Atomic Energy Commission). U. S. Patent 2,647,175, July 28, 1953.

This patent describes a method and apparatus for amplifying electrical impulses with an exceptionally short resolution time. A preferred embodiment includes the combination of an elongated cathode, an elongated anode, and at least one elongated control electrode disposed in parallel relation. The control electrode is apportioned into a propagating portion for the impulses to be amplified and a nonpropagating portion. Suitable input and output connections are provided for the electrical impulses to be amplified.

5239

ISOTOPE SEPARATING APPARATUS. W. E. Parkins (to U. S. Atomic Energy Commission). U. S. Patent 2,647,213, July 28, 1953.

This patent describes an electromagnetic isotope-separation apparatus having apertured accelerating and decelerating electrodes which are so arranged as to reduce flaring in the direction of the magnetic field in the ion beam projected through the electrodes.

5240

HEAT SEALING APPARATUS. G. J. Selvin (to U. S. Atomic Energy Commission). U. S. Patent 2,647,557, August 4, 1953.

This patent relates to a method and apparatus for sealing and cutting plastic tubing. The apparatus is highly mobile and maneuverable and adapted for remote manual operations, thus affording safety for an operator when handling toxic or radioactive materials.

5241

MASS SPECTROMETER ION SOURCE. W. T. Leland (to U. S. Atomic Energy Commission). U. S. Patent 2,643,341, June 23, 1953.

This invention relates to a method and apparatus for ejecting the ions from the ion chamber of a mass spectrometer and for selectively focusing ions of different masses. The invention is adapted to be adjusted over a wide range of potential differences and therefore is useful over a wide range of masses without loss of sensitivity.

5242

IONIZATION GAUGE. K. M. Simpson (to U. S. Atomic Energy Commission). U. S. Patent 2,643,342, June 23, 1953.

This invention relates to an ionization gage for a mass spectrometer and more specifically to an ionization gage of the Phillips or Penning type employing the magnetic field of the mass spectrometer. Calibration of the gage is independent of magnetic-field-strength variations. Leakage of stray ions and electrons from the beam is militated against, thus rendering the gage sensitivity independent of the mass-spectrometer beam intensity. A d-c voltage is applied between the cathode and anodes, the gage performing its own rectification.

5243

BALANCED DOUBLE IONIZATION CHAMBER X-RAY MONITOR. L. J. Rainwater (to U. S. Atomic Energy Commission). U. S. Patent 2,643,343, June 23, 1953.

This invention relates to an apparatus for monitoring x-ray peak voltage. The apparatus is adapted to measure deviation from a certain intensity of x rays and is provided with means which facilitate readjustment of the x-ray intensity at a given value after a lapse of time.

5244

VOLTAGE SUPPLY REGULATOR. E. Fairstein (to U. S. Atomic Energy Commission). U. S. Patent 2,643,360, June 23, 1953.

This invention relates to a voltage-supply regulator which may be inserted in either the positive or the negative lead of a d-c supply line to produce effective regulation. The invention is especially useful in the regulation of high-current negative-voltage supplies.

5245

MAGNETIC FLUX DIRECTION DETERMINING APPARA-

TUS. D. C. Sewell (to U. S. Atomic Energy Commission). U. S. Patent 2,644,922, July 7, 1953.

This patent describes a simple, rugged, and portable apparatus which is useful to quickly and accurately determine the direction of magnetic lines of force with extreme precision in the presence of an electrostatic field.

5246

PROCESS FOR THE SEPARATION OF ISOTOPIC IONS. S. L. Madorsky and A. K. Brewer (to U. S. Atomic Energy Commission). U. S. Patent 2,645,610, July 14, 1953.

The method here employed is one in which ions of different charge-to-mass ratios in an aqueous medium are transported at different rates in an electric field in a direction opposite to the flow of the dispersion medium. The rate of flow of the medium may be adjusted so as to continuously sweep back the slower moving ion.

5247

ATMOSPHERIC DUST COLLECTOR. E. G. Reid (to U. S. Atomic Energy Commission). U. S. Patent 2,645,941, July 21, 1953.

This patent covers an airborne device for collecting samples of atmospheric dust. The device is mounted within a streamlined body mounted on an aircraft. Mounted within such body is a rotatable cylinder having an intake opening and an outlet with a filter disposed across the path therebetween. Means are provided to permit the removal of the filter even when the aircraft is in motion.

5248

WELL CASING SOIL SAMPLER. H. E. Hylbak (to U. S. Atomic Energy Commission). U. S. Patent 2,646,252, July 21, 1953.

This invention relates to an apparatus for collecting samples from the side of a cased well. The apparatus comprises a drill bit for boring a hole in the casing, an auger bit for extracting soil specimens through the hole, a ram for plugging the hole and means for actuating the above elements.

5249

RADIO-FREQUENCY OSCILLATOR. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,642,531, June 16, 1953.

This patent describes a r-f oscillator for a cyclotron. The oscillator circuit is of a floating construction and has a low-impedance capacitive drive to supply r-f voltage which is free from parasitic oscillations.

5250

MULTICHANNEL ANALYZER. G. G. Kelley (to U. S. Atomic Energy Commission). U. S. Patent 2,642,527, June 16, 1953.

This patent describes a pulse analyzer of the multichannel type employed in the precision sorting of pulses according to magnitude, and is especially useful in connection with the scintillation spectrometer or proportional counter.

5251

POINT ELECTRON SOURCE. L. J. Cook (to U. S. Atomic Energy Commission). U. S. Patent 2,640,950, June 2, 1953.

This patent relates to an improvement in electron sources and is particularly concerned with improvements in "point electron sources." The apparatus comprises a concave surface with an aperture in its center, an electron-emissive element disposed within the aperture, an activating material about the electron-emitting element, and means to volatilize the activating material.

5252

ELECTRON SOURCE. L. J. Cook (to U. S. Atomic Energy Commission). U. S. Patent 2,640,949, June 2, 1953.

This patent describes an improvement in electron sources and is, in particular, concerned with an improved method and means for producing an intense electron beam emitted in a controlled direction with a minimum power expenditure. The electron-producing means comprises, in part, an activating material disposed about a heater. The heat causes a part of the activating material to volatilize and pass through apertures in its envelope. The activating material forms an electron-emissive layer of monatomic thickness on the wall of the envelope. An example of a suitable combination is an activating material of barium aluminate and a face formed of zirconium.

5253

MASS SPECTROMETER CONTROL. S. B. Spracklen (to U. S. Atomic Energy Commission). U. S. Patent 2,640,935, June 2, 1953.

This invention is concerned with mass spectrometers and their operation and provides improvements to the end that proper sensitivity is maintained by insuring against operation above an established critical pressure, and that protection is provided for the elements within the mass spectrometer against excessive pressure increases.

5254

ACCELERATOR TARGET. E. M. McMillan (to U. S. Atomic Energy Commission). U. S. Patent 2,640,924, June 2, 1953.

This patent describes an improvement in targets for particle accelerators and a method for producing an intense divergent x-ray beam. The method comprises producing a high-energy electron beam traversing orbital paths of constantly decreasing radius in an electron accelerator, intercepting the electron beam with a thin plate of material having a low atomic number whereby the beam experiences an energy loss from ionization in the plate and the beam focus is substantially unimpaired, and bombarding a thick plate with the electron beam of reduced energy at the same angular point on the beam orbit as the beam interception and at a substantially decreased orbital radius therefrom.

5255

TORQUE COMPENSATED GALVANOMETER. W. M. Powell (to U. S. Atomic Energy Commission). U. S. Patent 2,640,866, June 2, 1953.

This invention relates to galvanometers and fluxmeters and specifically covers an improved means for compensating for the normal restoring torque of the usual torsional coil suspension employed in apparatus of this type. The compensating means employ the introduction of a current into the moving coil which is proportional to the angular deflection of the coil and is of such a polarity as to effectively neutralize the restoring torque for all positions of deflection range of the moving coil.

5256

STABILIZED PULSE CIRCUIT. M. W. Horrell (to U. S. Atomic Energy Commission). U. S. Patent 2,632,103, March 17, 1953.

This patent relates to an electrical circuit for providing stabilized output pulses having a predetermined width and a substantially rectangular shape. The circuit is particularly adapted for use where it is desired to obtain output pulses having a substantially uniform characteristic regardless of any changes in circuit parameters.

5257

SNAP SAMPLER. J. Kohl, E. C. Reid, and L. R. Zumwalt (to U. S. Atomic Energy Commission). U. S. Patent 2,645,940, July 21, 1953.

This patent covers an airborne device for sampling the gaseous and solid content of a radioactive cloud for purposes of analysis. The device is mounted in the nose of a drone aircraft, with the nozzle and tube extending forward

into the undisturbed air. The cloud components are "swallowed" by the sampler, passing through the nozzle and tube into a collapsed envelope. The envelope expands to a predetermined volume and then is automatically sealed.

5258

SURGE SUPPRESSOR. W. G. Stone (to U. S. Atomic Energy Commission). U. S. Patent 2,644,913, July 7, 1953.

This patent covers a device for suppressing electric surges and transients from surges and is especially useful in suppressing sparking in calutrons. The device is generally of tubular doughnut configuration and fabricated of a nonconducting material. The interior space is filled with a gas of a low ionization potential which will produce large ion currents. The device encircles a conductor of the high-voltage leads and is spaced therefrom, whereby surges above a predetermined magnitude in the conductor increase ionization of the gas to suppress the surges.

5259

RADIATION CURRENT SOURCE. H. H. Rossi (to U. S. Atomic Energy Commission). U. S. Patent 2,640,953, June 2, 1953.

This invention relates to a variable source of minute current which may be varied reproducibly. The source comprises a container having a gas therein ionized by emanations from an axially disposed radioactive source, a potential impressed on electrodes in the container to cause the ions to move, a collector electrode interposed in the path of the moving ions, and a movable shield disposed adjacent the collector electrode to collect at least a portion of the ions which move toward the collector electrode.